Annual Report
on
Technology Transfer and Related Technology Partnering Activities
at the
National Laboratories and Other Facilities

Fiscal Years 2007 and 2008

Prepared by:

Office of Laboratory Policy and Evaluation
Office of Science
and
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U.S. Department of Energy

In Coordination With:

Technology Transfer Policy Board
Technology Transfer Working Group

U.S. Department of Energy

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The *Annual Report on Technology Transfer and Related Partnering Activities at the National Laboratories and Other Facilities for Fiscal Years (FY) 2007 and 2008* is prepared in accordance with the requirements of the Technology Transfer and Commercialization Act of 2000 [15 USC 3710(f)1].

In FY2007, DOE's laboratories and facilities negotiated and executed 12,614 technology transfer-related transactions. These transactions included 697 new or active Cooperative Research and Development Agreements (CRADAs); 2,395 Work-for-Others (WFO) Agreements involving non-Federal entities (NFEs); 5,842 licenses of intellectual property (IP); and 3,680 user facility agreements. In addition, DOE national laboratories and facilities reported 1,575 inventions; filed 693 patent applications; were issued 441 patents; and logged more than 552,000 downloads of their copyrighted open-source software. Associated with these activities, DOE's laboratories and facilities reported $218.3 million of funds from NFEs for WFOs; $62.7 million of funds received from partners as part of CRADAs; and $39.2 million received in licensing income, including nearly $18.8 million in earned royalties.

In FY2008, DOE's laboratories and facilities negotiated and executed 12,204 technology transfer-related transactions. These transactions included 711 new or active CRADAs; 2,530 WFO Agreements involving non-Federal entities; 6,146 licenses of IP; and 2,817 user facility agreements. In addition, DOE national laboratories and facilities reported 1,460 inventions; filed 904 patent applications; were issued 370 patents; and logged more than 561,050 downloads of their copyrighted open-source software. Associated with these activities, DOE''s laboratories and facilities reported $229.5 million of funds from NFEs for WFOs; $73.9 million of funds received from partners as part of CRADAs; and $49.3 million in licensing income, including nearly $31.6 million in earned royalties.

These activities evidence a robust technical enterprise, enabled by DOE outreach and technology partnering. While these activities are intended to facilitate research and innovation and encourage the development and transfer of emerging technologies, they also contribute to DOE missions and strengthen the technical competencies of DOE's laboratories and facilities. The extent of this work is a reflection, as well, of the continued confidence in DOE on the part of thousands of private partners who work with DOE in these ways. This *Report* describes these activities and outlines DOE's procedures for ensuring appropriate management and oversight of their conduct, in accord with prevailing policy and authorities.

The many professional practitioners of technology transfer and the many dedicated scientists and engineers who have contributed to the numerous technology transfer successes throughout the DOE complex have played a valuable role in technology transfer for DOE. They and their management are encouraged to continue this excellent work. The resulting contributions add significantly to our Nation's economic competitiveness and to DOE's mission accomplishment.

Background

Technology transfer has been an aim of United States Federal Government policy since the passage of the Bayh-Dole (P.L. 96-517, as amended by P.L. 98-620) and the Stevenson-Wydler (P.L. 96-480) legislation during the early 1980s. In 1989, the National Competitiveness Technology Transfer Act (P.L. 99-502) strengthened this goal by establishing technology transfer as a mission of Federal R&D agencies, including the Department of Energy (DOE). Since then, DOE has encouraged its national laboratories and production facilities to enter into technology partnering activities with non-Federal entities, as appropriate and using a variety of mechanisms. DOE has also authorized its facilities to patent and to license intellectual property (IP) resulting from DOE research and development (R&D) and to collect and to dispose appropriately of related royalties and fees. For the purpose of this document, "technology transfer" refers to the process that enables the use of existing knowledge, intellectual property, facilities or capabilities developed at the Department of Energy's National Laboratories and facilities to meet public and private needs.

Today, technology partnering is an active component of DOE's overall mission to promote scientific and technological innovation that advances the economic, energy, and national security interests of the United States. Technology transfer is now carried out at all 17 DOE national laboratories and at 5 other DOE research and/or production facilities. The contractor-operated laboratories and facilities are authorized and required to conduct technology transfer by provisions in DOE's laboratory management and operating (M&O) contracts. Motivated by mutual self-interest and notably without transfer of Federal funds to the non-Federal partners, these arrangements provide a means for collaboration and cooperation between DOE and the private sector, and allow each party to leverage resources to achieve its mission.

Technology partnering is important in furthering the vibrancy of technical competencies at DOE's research laboratories and facilities. DOE can best accomplish its mission as part of the greater scientific and technical community. DOE must have access to the rapidly evolving technical expertise and commercial technology of selected non-Federal entities through transfer of know-how and technology from the private sector to the Federal sector. Similarly, the DOE laboratories and facilities can benefit from others with the skills to develop, to commercialize, and to distribute the benefit of knowledge from its IP into society for greater public benefit. Non-Federal entities often have more experience and other resources to successfully accomplish this goal than those in the Federal sector. Therefore, DOE can best achieve its technology transfer mission by developing and sustaining partnerships with such firms.

Private firms and other non-Federal entities have found that DOE's research laboratories and facilities can provide, to the benefit of their own objectives, valuable and often unique problem solving capabilities, and in some cases, they are interested in building long-term relationships with DOE that yield greater results over time.

Technology Partnering Policy

In FY2007, the Secretary of Energy reemphasized the Department's commitment to strengthening its technology transfer program with the release of his *Secretarial Policy Statement on Technology Transfer at Department of Energy Facilities*, a copy of which is attached as Appendix D. This policy statement replaces DOE Order 482.1 which, beginning in 2001, had governed technology partnering activities at DOE laboratories and facilities.

The *Policy Statement* builds on the technology transfer stimulus in the Energy Policy Act of 2005 (EPAct 2005), Title X, Section 1001 (a copy of which is attached as Appendix E), by establishing a more formal link between technology transfer and elements of the Department's mission – specifically, to advance scientific discovery and the nation's energy security and economic competitiveness. The *Policy Statement* states guiding principles for technology transfer activities, as well as roles for individuals and groups responsible for monitoring and implementing those principles.

Laboratories and Facilities Engaged in Technology Transfer

DOE authorizes all 17 of its national laboratories and another 5 of its production facilities to conduct technology partnering activities. Most of these laboratories and facilities have established formal technology transfer programs with staff dedicated to the facilitation of the administrative and negotiating processes involved in entering into agreements with non-Federal partners. This Report presents trends and analyses of the technology transfer activities at the aggregate level for DOE.

The laboratories and facilities authorized by DOE to carry out technology transfer activities are listed below, grouped by the Departmental component that oversees the laboratory. These 22 entities constitute the source of data included in this Report[1].

Office of Science

- Ames National Laboratory
- Argonne National Laboratory
- Brookhaven National Laboratory
- Fermi National Accelerator Laboratory
- Lawrence Berkeley National Laboratory
- Oak Ridge National Laboratory
- Pacific Northwest National Laboratory
- Princeton Plasma Physics Laboratory
- Stanford Linear Accelerator Center[2]
- Thomas Jefferson National Accelerator Facility

National Nuclear Security Administration

- Bettis and Knolls Atomic Power Laboratories
- Kansas City Plant
- Lawrence Livermore National Laboratory
- Los Alamos National Laboratory
- Nevada Test Site
- Pantex Plant
- Sandia National Laboratories
- Y-12 National Security Complex

Office of Energy Efficiency and Renewable Energy

- National Energy Technology Laboratory

Office of Nuclear Energy

- Idaho National Laboratory

Office of Fossil Energy

- National Renewable Energy Laboratory

Environmental Management

- Savannah River National Laboratory

Summary of Fiscal Year 2007 Transactions

In FY 2007, DOE's its laboratories and facilities negotiated and executed 12,614 technology transfer-related transactions. These transactions included 697 new or active Cooperative Research and Development Agreements (CRADAs); 2,395 Work-for-Others (WFO) Agreements involving non-Federal entities (NFEs); 5,842 licenses of intellectual property (IP); and 3,680 user facility agreements. In addition, DOE national laboratories and facilities reported 1,575 inventions; filed 693 patent applications; were issued 441 patents; and logged more than 552,000 downloads of their copyrighted open-source software.

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[1] Nevada Test Site did not provide any data for FY 2007.
[2] The Stanford Linear Accelerator Center was renamed the SLAC National Accelerator Laboratory on October 15, 2008.

Summary of Fiscal Year 2008 Transactions

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Table 1: Summary of FY 2007 and FY2008 Technology Partnering Activities at DOE National Laboratories and Facilities

Technology Transfer Data Element	FY 2007	FY 2008
Transactions and Activities		
CRADAs, total active in the FY	697	711
New inventions disclosed	1,575	1,460
Patent applications filed	693	904
Patents issued	441	370
Licenses, total active in the FY	5,842	6,146
· Invention Licenses	1,354	1,448
· Other IP (copyright, material transfer, other) Licenses	4,488	4,698
Licenses that are income-bearing	3,291	4,397
Work-for-Others Agreements – NFEs, total active in FY	2,395	2,530
User Facility Agreements, total active in FY	3,680	2,817
Reported Income (Thousands of Dollars)		
Total Licensing Income Received	$39,166	$49,319
· Invention Licenses	$34,933	$43,108
· Other Licenses	$4,233	$6,211
Total Royalty Income Earned	$18,759	$31,640

The FY 2001 Energy and Water Development Appropriations Act requires an annual report on the status of technology transfer programs at the National Nuclear Security Administration's (NNSA) facilities. NNSA's response to its required annual report is incorporated here as Appendix B.

Accomplishments

There are numerous examples of technology partnerships that reflect the successful transfer of technologies out of the laboratory and into the marketplace. Representative accomplishments for FY 2007 and FY 2008 are presented in Appendix C.

Organization, Management, and Oversight

DOE encourages and exercises oversight, management and administration of its technology partnering activities at its national laboratories and facilities. The primary means are described below.

Implementation of the Energy Policy Act of 2005

The Energy Policy Act of 2005 (EPAct 2005), Title X, Section 1001, directs the Department of Energy to accomplish several goals with regard to its technology transfer activities. The Department made progress towards implementing these goals in FY 2007 and FY 2008.

Technology Transfer Coordinator

EPAct 2005, Title X, Section 1001(a-c) instructs the Secretary of Energy to appoint a Technology Transfer Coordinator to serve as the "principal advisor to the Secretary on all matters relating to technology transfer and commercialization." Energy Secretary Samuel Bodman met this need by appointing Dr. Raymond L. Orbach, Under Secretary for Science, as the Department's first Technology Transfer Coordinator in FY 2007. In accordance with EPAct 2005, the Technology Transfer Coordinator chartered and began to oversee the activities of a Technology Transfer Working Group (TTWG), the allocation of technology transfer funds within the Department, and to engage private sector entities, including venture capital companies, in the Department's technology transfer efforts. The Technology Transfer Coordinator also established a Technology Transfer Policy Board (TTBP) on July 18, 2007.

Under EPAct 2005, the Technology Transfer Coordinator is also responsible for overseeing the activities of the DOE technology partnership ombudsman (ombuds). The ombuds, appointed by the laboratory and facility directors to help resolve technology transfer complaints from outside organizations[3], receive guidance from the Department's Office of Conflict Prevention and Resolution (OCPR). In coordination with the Technology Transfer Coordinator and the Office of the Assistant General Counsel for Technology Transfer and Intellectual Property, OCPR provides periodic training to the designated laboratory and facility ombuds in intellectual property and ombuds skills. OCPR also facilitates information exchange between ombuds as part of the educational process.

Technology Transfer Working Group

Most technology transfer conducted by DOE occurs in the field at the Department's national laboratories, plants, and sites; thus, it is critical for the Department to coordinate its efforts with those of the field. As directed by EPAct Title X, Section 1001(d), in FY 2007, the Technology Transfer Coordinator, with the assistance of the Technology Transfer Policy Board, developed a charter and list of responsibilities for a Technology Transfer Working Group (TTWG). They also tapped the DOE national laboratories, single purpose research and production facilities, and field elements for representatives to serve on the TTWG.

Alternative Dispute Resolution/Ombuds

DOE's Office of Conflict Prevention and Resolution (OCPR), in DOE's Office of General Counsel, provides guidance on the use of Alternative Dispute Resolution (ADR) techniques to DOE laboratories and facilities in a number of key areas, including environmental matters, procurement and technology transfer issues, and

[3] Technology Transfer Commercialization Act of 2000, Section 11, 42 U.S.C. 7261c.

workplace issues. OCPR also coordinates with the Office of the Assistant General Counsel for Technology Transfer and Intellectual Property in working with the individual ombuds at sites throughout the DOE complex to address IP disputes at the earliest possible stage.

In FY 2007, ombuds at DOE's national laboratories and facilities were involved in eight potential disputes involving CRADAS, patents, licenses, or other issues. Six of these issues were resolved and two were unresolved. In FY 2008, ombuds at DOE's national laboratories and facilities were involved in 19 potential disputes involving CRADAS, patents, licenses, Work-for Others, or other issues. Thirteen of these issues were resolved, three are still pending, and three were withdrawn.

Technology Transfer Policy Board

The Technology Transfer Policy Board (TTPB) is chaired by the Technology Transfer Coordinator, with representatives from the Department's major Program and Staff Offices engaged in technology transfer, including the National Nuclear Security Administration (NNSA), the Office of Science (SC), and the applied research programs of Energy Efficiency and Renewable Energy (EE), Nuclear Energy (NE), Fossil Energy (FE), and Electricity Delivery and Energy Reliability (OE), as well as the Offices of the General Counsel (GC), Management & Administration (MA), and Policy and International Affairs (PI). The Board representation entirely consists of career DOE employees, which is intended to ensure continuity of functions that are essential to sustaining effective implementation of technology transfer policies and practices throughout the Department and across administrations.

The Board develops policy recommendations for the Coordinator and monitors the overall technology transfer activities across the DOE complex in coordination with the Technology Transfer Coordinator. It also, among other things, supports the Technology Transfer Coordinator in overseeing the activities of the Technology Transfer Working Group and ombudsmen; oversees and develops proposed policies governing the technology transfer activities at laboratories and facilities; oversees and encourages efforts to engage private sector entities, including venture capital companies; develops proposed policies intended to promote consistency and uniformity applicable to User Agreements; provides recommendations on measuring the success of technology transfer programs and advises the Coordinator on the oversight of and success of the Department's technology transfer program. The Board also serves as a vehicle to help facilitate and coordinate technology transfer activities and the exchange of information across functional units of DOE. The Board meets monthly at DOE Headquarters.

In FY 2007, the Board drafted the *Secretarial Policy Statement on Technology Transfer*, a document designed to demonstrate the importance of technology transfer within the Department and to lay out a new framework for technology transfer activities at DOE laboratories and facilities, incorporating input from the laboratories and Federal field offices. The *Policy Statement* was signed by Energy Secretary Bodman on January 31, 2008.

Federal Multi-Agency Coordination and Liaison Activities

DOE participates in the Federal Interagency Working Group on Technology Transfer (IWG), led by the Technology Administration, U.S. Department of Commerce. The IWG serves as an interagency forum for the exchange of information and as a vehicle for raising and addressing issues and concerns related to technology transfer across the Federal government. It meets monthly and is attended by agency representatives and patent counsels from 17 Federal agencies.

Federal Laboratory Consortium on Technology Transfer

The Federal Laboratory Consortium for Technology Transfer (FLC) was organized in 1974 and formally chartered by the Federal technology Transfer Act of 1986 to promote and strengthen technology transfer nationwide. Its membership draws from about 250 Federal laboratories, including DOE's 22 national laboratories and production facilities. As required by statute, in FY 2007, DOE contributed $422,280 of the $2,649,998 of funding contributed by federal agencies for the operating costs of the FLC. In FY 2008, DOE contributed $416,000 for FLC operations. The FLC is supported by a contract between the National Institute of Standards

and Technology (NIST), the U.S. Department of Commerce, and the Universal Technical Resource Services, Inc., of Cherry Hill, New Jersey.

Technology Partnering and Related Activities**:** Research and Development Agreements with Industry and Others

Technology partnering encompasses several activities, and the most appropriate partnering mechanism depends on the objective of each partner. The most commonly used technology transfer mechanisms are described below.

- **Cooperative Research and Development Agreements (CRADAs).** Negotiating all aspects of and entering into Cooperative Research and Development Agreements (CRADAs), performed under the National Competitiveness Technology Transfer Act of 1989. Such agreements typically focus on mutually beneficial collaborative research. They may involve resource commitments by each partner for its own use, or resource commitments from the non-Federal partner to the Federal partner, but no funding commitments from the Federal partner to non-Federal partner are permitted.

- **Work-for-Others (WFOs).** Performing work for non-Federal sponsors under DOE Order 481.1. WFO agreements permit reimbursable research and development to be carried out at DOE laboratories or facilities. This work is usually categorized into that for Federal agencies and non-Federal entities (NFE). It is the NFE work that is included as technology partnering in this report. For proprietary R&D conducted for NFEs, the Federal laboratory or facility is reimbursed by the NFE sponsor for the full cost of the activity. If the work will be published, cost may be adjusted. Intellectual property rights generally vest in the NFE, but may be negotiated.

- **User Facilities.** Making available laboratory or weapon production user facilities. User facility agreements permit non-Federal entities to conduct research and development at a laboratory or use a particular scientific facility or instrument. For proprietary R&D, the laboratory is reimbursed by the user for the full cost of the activity. If the work will be published, cost may be adjusted. Intellectual property rights generally vest in the user.

- **Intellectual Property.** Identifying and protecting intellectual property made, created, or acquired at or by a DOE facility. This includes new invention disclosures; creation and filings of patent applications; patent issues; and associated monitoring and reporting.

- **Licensing.** Negotiating and entering into license agreements and bailments that provide rights in intellectual property made, created, or acquired at or by a DOE facility and which is controlled or owned by the contractor for that facility. A license transfers *less* than ownership rights to intellectual property, such as a patent or software copyright, to permit its use by the licensee. Licenses may be exclusive, or limited to a specific field of use, or limited to a specific geographical area. A potential licensee must present plans for commercialization. Royalties and income are often associated with the licensing.

- **Personnel Exchanges.** These arrangements allow facility staff to work in a partner's technical facilities, or the partner's staff to work in the government laboratory, in order to enhance technical capabilities and/or support research in certain areas. Costs are typically borne by the sponsoring organization. IP arrangements may be negotiated as part of these exchanges. (Personnel Exchange activities are not included in this report.)

- **Technical Assistance**. Technical consulting usually takes the form of technical assistance to small businesses, undertaken in response to an inquiry or request for such assistance from an individual or organization seeking knowledge, understanding or solutions to a problem, or means to improve a process or product. The extent of such consulting is limited to a relatively low level of overall effort. (Technical Assistance activities are not included in this report.)

CRADAs, WFOs, and User Facility Agreements

Cooperative Research and Development Agreements (CRADAs), Work-for-Others Agreements (WFOs), and User Facility Agreements are used by the DOE national laboratories and facilities to partner with industry on research and development (R&D). These partnerships join laboratory scientists with members of industry and serve as opportunities for technology development and maturation. Furthermore, these arrangements provide a mechanism for industry partners to gain greater experience with the technical capabilities at the national laboratories, and can often lead to follow-on research projects that are mutually beneficial.

DOE scientific user facilities are advanced, world-class, unique scientific facilities and equipment that are available at DOE laboratories for the technical and scientific community. These facilities are intended to serve the research needs of the Federal government, the national laboratory scientists and, at the same time, are intended to be a national resource available for research by industry and university investigators. DOE's Office of Science (SC) oversees a number of scientific user facilities; the National Nuclear Security Administration (NNSA) also oversees a number of Technology Deployment Centers and user facilities. In FY2008, DOE streamlined access for the industrial and scientific community to certain designated facilities by issuing new user agreements – one that clarifies the intellectual property and data rights that vest in non-proprietary users that agree to publish results, and another for proprietary users that are not required to publish results, but pay the cost of using the facility.

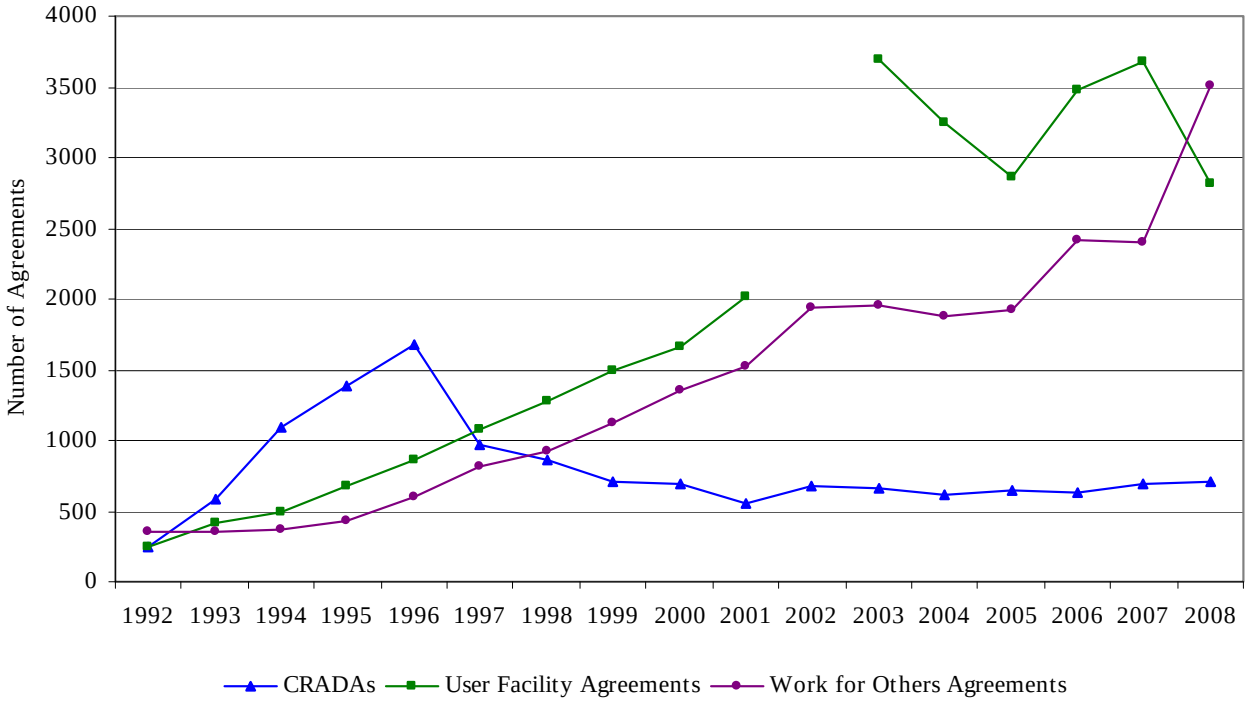
Figure 1 shows the trends for CRADA, WFO, and User Facility Agreements since 1992. The number of active CRADAs grew rapidly to just over 1,600 by FY 1996. After FY 1996, there was a precipitous drop in new CRADAs and by FY 2001, there were 558 active agreements. Since that time, the number of active CRADAs has remained relatively steady, at approximately 640 active agreements each year.

During the early increase, the numbers of CRADAs correlated closely with the federal funding allocated to support them. In the early 1990s, Congress provided dedicated CRADA funding through the Technology Partnership Program and the Laboratory Technology Research Program. The combined Technology Partnership and Laboratory Technology Research Programs funding reached $261 million in FY 1995, but declined to zero in FY 2004. In recent years, despite the fact that there is no longer federal funding for CRADAs, their number has remained steady due to the ability of a Federal entity to accept funding from a collaborator under the CRADA. In this type of CRADA, the industry partner pays 100 percent of the costs for the laboratory's staff, facilities and equipment. In FY 2007, for example, about $62.7 million of private sector funds were received by the DOE laboratories and facilities for CRADAs, and in FY 2008, there were about $73.9 million of such funds received.

WFO agreements with non-Federal entities (NFEs) consistently increased since 1992 with an accompanying influx of funds from businesses and other non-Federal entities to the national laboratories (see **Figure 1).** In effect, WFO has replaced CRADAs as the primary means for collaborating and funding R&D projects with industry at DOE laboratories.

Figure 1 also shows that the number of User Facility agreements at DOE laboratories and facilities has grown substantially since the early 1990s. Despite their decline in FY 2004 and 2005, the level of activity increased in 2006 and again in 2007 with a decline in FY 2008 from the high of 3,680 active User Facility Agreements in FY 2007, the latter drop corresponding to an increase in WFO during the same period.

Figure 1: Trends in CRADAs, Work-for-Others Agreements, and User Facility Agreements



Licenses and Licensing Income

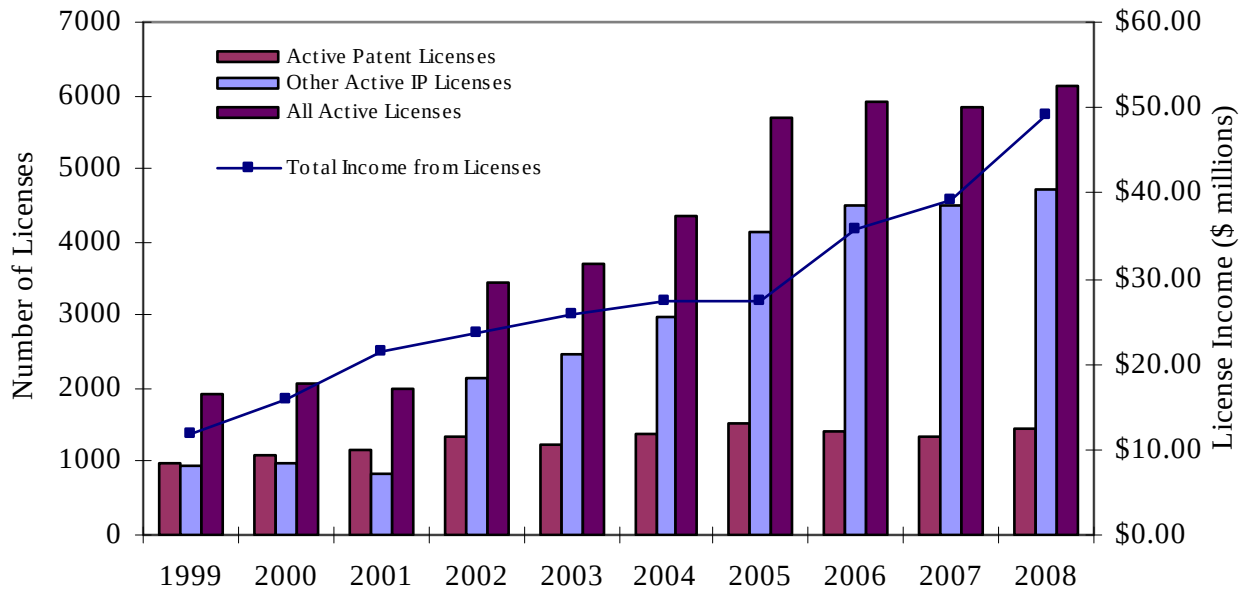
Figure 2 presents data on the number of licenses and amount of income from licenses during the period FY 1999-2008. The total number of active licenses is provided, as well as a break down of individual components of the total showing active patent (invention) licenses and other active licenses. Other licenses include copyrighted software, biological materials and other forms of IP. Open source software have been excluded from these figures since no licensing income is derived from their licensing. Copyright licenses make up the bulk of "other IP" licenses.

The steady growth in licensing activity shown in **Figure 2** is due principally to the growth in copyright licenses. The vast majority of copyright licenses are associated with software. The number of active licenses has more than tripled since 1999, growing from 1,922 (FY 1999) to 6,146 (FY 2008).

Figure 2 also shows the growth in income from licensing agreements. Licensing income has also quadrupled over the past 9 years, growing from less than $12 million in FY 1999, to nearly $50 million in FY 2008.

Licensing income may be used by laboratories and facilities in a number of ways, provided it is consistent with DOE policy, M&O contract provisions, and the goals of each laboratory or facility's institutional management plan. In general, licensing income is distributed among the inventors, other contributors, and the laboratory. The inventor/contributor share is typically tiered so that it adjusts for income below and above certain thresholds, and ranges from 15-50 percent depending on the tier. For the laboratory share, a portion is sometimes distributed to the laboratory division or program where the inventions are created and is typically used for education and training, supporting other R&D projects that are not sponsored by DOE programs and, in some cases, technology maturation. The remainder of the laboratory share is distributed elsewhere at the laboratory for related research, development and technology transfer purposes, including a portion to the laboratory's technology transfer office for its use in technology maturation for regional economic development and other projects.

Figure 2: Trends in Licensing and Licensing Income



Appendix A:

Technology Transfer Activities for Fiscal Years 2004-2008

The Technology Transfer Commercialization Act of 2000 (P.L. 106-404) requires each Federal agency that operates or directs Federal laboratories or that engages in patenting or licensing of Federally owned inventions to provide the Office of Management and Budget (OMB) with an annual report on its technology transfer plans and recent achievements. A copy is also provided to the Technology Administration Office of the Department of Commerce. The Secretary of Commerce prepares an overall Federal assessment of technology transfer activities for the President and Congress based on the program information in these agency reports. Specific data requirements to be reported each year are established by the Department of Commerce.

In accordance with OMB's reporting guidelines, DOE's technology transfer data for fiscal years 2004-2008 are shown in **Table 2** below. The table continues on the following pages.

Table 2: Department of Energy's Technology Transfer Activities, Fiscal Years 2004-2007

Cooperative Research and Development Agreements

	FY 2004	FY 2005	FY 2006	FY2007	FY2008
• CRADAs, total active in the FY (1)	610	644	631	697	711
- New, executed in the FY	157	164	168	182	178
▪ Traditional CRADAs, (2) total active in the FY	Nr	Nr	Nr	Nr	Nr
- New, executed in the FY	Nr	Nr	Nr	Nr	Nr
▪ Non-traditional CRADAs, total active in FY	Nr	Nr	Nr	Nr	Nr
- New, executed in the FY	Nr	Nr	Nr	Nr	Nr
• Other collaborative R&D relationships					

(1) "Active" = legally in force at any time during the FY. "Total active" is comprehensive of all agreements executed under CRADA authority (15 USC 3710a).
(2) CRADAs involving collaborative research and development by a federal laboratory and non-federal partners.

Invention Disclosure and Patenting

	FY 2004	FY 2005	FY 2006	FY2007	FY2008
• New inventions disclosed in the FY [1]	1,617	1,776	1,694	1,575	1,460
• Patent applications filed in the FY	661	812	726	693	904
• Patents issued in the FY	520	467	438	441	370

(1) Inventions arising at the DOE laboratories and facilities.

Licensing

Profile of Active Licenses					
	FY 2004	**FY 2005**	**FY 2006**	**FY2007**	**FY2008**
• All licenses, total active in the FY [(1)]	4,345	5,677	5,916	5,842	6,146
- New, executed in the FY	616	750	652	606	685
▪ Invention licenses, total active in the FY	1,362	1,535	1,420	1,354	1,448
· New, executed in the FY	168	198	203	164	177
- Patent licenses, total active in FY	1,362	1,535	1,420	1,354	1,448
· New, executed in the FY	168	198	203	164	177
- Material transfer (inventions), total active in FY	0	0	0	0	0
· New, executed in the FY	0	0	0	0	0
- Other invention licenses, total active in FY	--	--	--	--	--
· New, executed in the FY	--	--	--	--	--
▪ Other IP licenses, total active in the FY	2,983	4,142	4,496	4,488	4,698
· New, executed in the FY	449	553	449	442	508
- Copyright licenses	2,136	3,042	3,238	2,975	3,149
· New, executed in the FY	217	289	184	210	270
- Material transfer (non-inv.), total active in FY	794	999	1,110	1,315	1,345
· New, executed in the FY	208	229	228	223	222
- Other [(2)]	53	101	148	198	204
· New, executed in the FY	24	35	37	9	16

(1) "Active" = legally in force at any time during the FY.
(2) Bailment agreements, trademark, etc.

Profile of Active Licenses (cont'd)					
	FY 2004	**FY 2005**	**FY 2006**	**FY2007**	**FY2008**
• All income bearing licenses [(1)]	3,236	2,549	2,822	3,291	4,397
- Exclusive	255	248	353	352	372
- Partially exclusive	638	287	283	656	652
- Non-exclusive	2,343	2,014	2,186	2,283	3,373
▪ Invention licenses, income bearing	1,151	1,148	1,245	1,291	1,418
- Exclusive	223	223	295	279	297
- Partially exclusive	189	244	245	318	316
- Non-exclusive	739	681	743	727	840
- Patent licenses, income bearing [(2)]	1,151	1,148	1,245	1,291	1,418
- Exclusive	223	223	295	279	297
- Partially exclusive	189	244	245	318	316
- Non-exclusive	739	681	743	727	840
▪ Other IP licenses, income bearing	2,085	1,402	1,540	1968	2,945
- Exclusive	32	26	59	74	76
- Partially exclusive	449	43	38	338	336
- Non-exclusive	1,604	1,333	1,443	1556	2,533
- Copyright licenses (fee bearing)	1,993	1,233	1,454	1,671	2,669
- Exclusive	30	25	58	74	70
- Partially exclusive	448	39	32	325	323
- Non-exclusive	1,515	1,169	1,364	1,272	2,276
- Other IP licenses	92	169	86	297	276
- Exclusive	2	1	1	0	6
- Partially exclusive	1	4	6	13	13
- Non-exclusive	89	164	79	284	257
• All royalty bearing licenses [(3)]	3,236	2,549	2,822	3,291	4,397
▪ Invention licenses, royalty bearing, number	1,083	1,148	1,245	1,291	1,418
▪ Patent licenses royalty bearing	1,151	1,148	1,245	1,291	1,418
▪ Other IP licenses, royalty bearing	2,085	1,402	1,540	1,968	2,945
- Copyright licenses (fee bearing)	1,993	1,233	1,454	1,671	2,669
- Other IP licenses	92	169	86	297	276

(1) "All income bearing licenses" are equal to the sum of "invention licenses" and "other IP licenses."
(2) For purposes of DOE reporting, "invention licenses" are the same as "patent licenses."
(3) "All royalty bearing licenses" are the same as "all income bearing licenses."

Licensing Management

	FY 2004	FY 2005	FY 2006	FY2007	FY2008
• Elapsed execution time, licenses granted in FY (days)					
▪ Invention licenses					
- Median	133	62	104	64	91
- Minimum	8	0.5	1	1	0
- Maximum	745	1,777	1,750	2,614	798
- Patent licenses					
- Average (or median)	133	62	102	64	91
- Minimum	8	0.5	1	1	0
- Maximum	745	1,777	1,750	2,614	798
• Number of licenses terminated for cause in FY					
▪ Invention (Patent) licenses	35	31	21	29	52

Annual License Income ($ thousands)

	FY 2004	FY 2005	FY 2006	FY2007	FY2008
• Total income, all licenses active in FY [(1)]	$27,252	$27,382	$35,572	$39,165	$49,318
▪ Invention licenses	$23,321	$24,226	$32,211	$34,933	$43,108
- Patent licenses	$23,670	$24,226	$32,211	$34,933	$43,108
▪ Other IP licenses, total active in the FY	$3,931	$3,156	$3,362	$4,233	$6,210
- Copyright licenses	$2,678	$3,140	$3,218	$3,115	$5,615
- Other			$143	$1,118	$595
• Total Earned Royalty Income (ERI) ($thousands)	$10,882	$12,443	$18,332	$18,759	$31,640
- Median ERI	$4	$4	$3	$2	$5
- Minimum ERI	$0.004	$0.004	$0.007	0	$0
- Maximum ERI	$2,600	$1,752	$6,489	$5,377	$6,252
- ERI from top 1% of licenses	$3,977	$3,486	$10,063	$7,660	$14,119
- ERI from top 5% of licenses	$8,837	$8,933	$13,697	$10,540	$22,318
- ERI from top 20% of licenses	$12,743	$11,152	$16,262	$11,576	$26,225
▪ Invention licenses					
- Median ERI	$5	$5	$6	$2	$8
- Minimum ERI	$0.006	$0.005	$0.007	0	$.001
- Maximum ERI	$2,600	$1,752	$6,489	$5,377	$6,252
- ERI from top 1% of licenses	$3,977	$3,486	$9,502	$7,044	$10,519
- ERI from top 5% of licenses	$7,299	$7,571	$12,776	$9,984	$17,223
- ERI from top 20% of licenses	$10,729	$10,270	$15,499	$11,426	$20,468
- Patent licenses					
- Median ERI	$5	$5	$6	$2	$8
- Minimum ERI	$0.006	$0.005	$0.007	0	$.001
- Maximum ERI	$2,600	$1,752	$6,489	$5,377	$6,252
- ERI from top 1% of licenses	$3,977	$3,486	$9,502	$7,044	$10,519
- ERI from top 5% of licenses	$7,299	$7,571	$12,776	$9,984	$17,223
- ERI from top 20% of licenses	$10,729	$10,270	$15,499	$11,426	$20,468

(1) Total income includes license issue fees, earned royalties, minimum annual royalties, paid-up license fees, and reimbursement for full-cost recovery of goods and services provided by the lab to the licensee including patent costs.

Annual License Income ($ thousands) (cont'd)

	FY 2004	FY 2005	FY 2006	FY2007	FY2008
▪ Other IP licenses					
- Median ERI	$2	$4	$3	$.02	$0
- Minimum ERI	$0.004	$0.004	$0.005	$3	$3
- Maximum ERI	$197	$233	$566	$1,273	$2,000
- ERI from top 1% of licenses	$197	$333	$568	$1,273	$2,360
- ERI from top 5% of licenses	$498	$502	$1,069	$1,564	$3,277
- ERI from top 20% of licenses	$660	$707	$1,427	$1,620	$3,843
- Copyright licenses (1)					
- Median ERI	$2	$4	$3	$7	$0
- Minimum ERI	$0.004	$0.004	$0.005	$3	$3
- Maximum ERI	$197	$233	$566	$2,113	$2,000
- ERI from top 1% of licenses	$197	$333	$568	$2,113	$2,358
- ERI from top 5% of licenses	$498	$502	$1,069	$3,782	$3,275
- ERI from top 20% of licenses	$659	$707	$1,427	$4,328	$3,842

Disposition of License Income ($ thousands)

• Income distributed (2) (thousands)					
▪ Invention licenses, total distributed	$18,622	$23,711	$25,931	$32,576	$37,307
- To inventors	$4,398	$5,267	$7,183	$8,077	$8,439
- To other	$14,224	$18,444	$22,143	$24,499	$28,868
- Patent licenses, total distributed	$18,622	$23,711	$25,931	$32,576	$37,307
- To inventors	$4,398	$5,267	$6,503	$8,077	$8,439
- To other	$14,224	$18,444	$19,428	$24,499	$28,868

Other Performance Measures Relevant to DOE

Work-for-Others Agreements – Non-federal entities	1,884	2,431	2,416	2,395	2,530
User Facility Agreements	3,252	2,859	3,470	3,680	2,817
Open Source Downloads		205,000	351,322	552,760	561,050

(1) Data not requested from agency in previous years and not available.
(2) Income includes royalties and other payments received during the FY.

Other Notes
-- Data not requested from agency in previous years' reports.
Nr Data not reported by DOE

APPENDIX B

Utilization of Industrial Partnerships within the National Nuclear Security Administration

Table of Contents

INTRODUCTION

Requirement for NNSA Report on Technology Transfer Programs

The FY-2001 Energy and Water Development Appropriations Act (Senate Report #106-395, page 122) requires an annual report on the status of technology transfer programs at the National Nuclear Security Administration's (NNSA) facilities. This appendix provides NNSA's response to the required annual report.

This appendix provides statistics and related information regarding NNSA technology transfer activities. NNSA technology partnering tools/mechanisms include, but are not limited to: Cooperative Research and Development Agreements (CRADAs), Licensing Agreements, Exchange of Personnel, and the use of Technical Assistance (Technical Consulting) to solve a particular problem or in the use of unique facilities/equipment such as User Facility Agreements, Work-for-Others (WFO), and Software Downloads.

Report Consolidation

NNSA has previously submitted reports titled "Report to Congress on the Utilization of Industrial Partnerships within the National Nuclear Security Administration" (NNSA Report on Industrial Partnerships) for each fiscal year. The information contained in the NNSA Report on Industrial Partnerships is similar to information contained in the Department of Energy's "Annual Report on Technology Transfer and Related Technology Partnering Activities at the National Laboratories and Other Facilities" (DOE Report on Technology Transfer). The NNSA Report on Industrial Partnerships only contains information regarding NNSA laboratories/facilities while the DOE Report on Technology Transfer contains information regarding all DOE laboratories and facilities (including NNSA laboratories and facilities).

In late 2007, NNSA and DOE informally submitted a proposal to Congress to combine the NNSA Report on Industrial Partnerships with the DOE Report on Technology Transfer and provide a single report to Congress on this important topic. While combining these reports is cost-effective, more importantly, it provides a single source of information to facilitate Congress's evaluation of the effectiveness of the DOE and NNSA programs.

Technology Partnering Goals

The overall technology partnering activity goals are:

- To facilitate the expeditious transfer of Federally-owned technology to non-DOE entities for the good of the Nation and to leverage DOE resources through its programs and facilities by partnering while enhancing core competencies for the DOE/NNSA.

- To ensure fairness of opportunity and to promote economic competitiveness in the United States.

The below listed documents identify roles, responsibilities, and guidance for oversight, management and administration of technology transfer activities within DOE and NNSA:

- DOE Order 481.1 C, "Work for Others (Non –Department of Energy Funded Work)"
- DOE Guide 481.1-1, "Work for Others Guide"
- DOE Manual 481.1-1A , "Reimbursable Work for Non Federal Sponsors Process Manual"
- DOE Order 482.1 "DOE Facilities Technology Partnering Programs"
- DOE Order 483.1 DOE Cooperative Research and Development Agreements"
- DOE Manual 483.1-1 "DOE Cooperative Research and Development Agreements Manual"

NNSA Complex Facilities

The NNSA Complex encompasses: Lawrence Livermore National Laboratory (LLNL), Los Alamos National Laboratory (LANL), Sandia National Laboratories (SNL), Savannah River National Laboratory (SRNL)*, Nevada Test Site (NTS), Kansas City Plant (KCP), Pantex Plant (PX), and Y-12 National Security Complex (Y-12).

Note: Though not a member of the NNSA nuclear weapon complex, Savannah River National Laboratory (SRNL) is included because it receives joint funding from Defense Programs, Office of Science, and Environmental Management.

TECHNOLOGY TRANSFER TOOL/MECHANISMS STATISTICAL OVERVIEW

Technology Transfer partnering tools/mechanisms are important to the vibrancy of the NNSA technical competencies at its research laboratories and facilities. Technology Transfer activities evidence a robust technical enterprise, enabled by NNSA outreach and technology partnering. While these activities are intended to facilitate research and innovation, and encourage development and transfer of emerging technologies, these technology transfer tools also contribute to NNSA missions, and strengthen the technical competencies of the NNSA Complex. This work is a reflection of the confidence that many private partners have in the capabilities of the NNSA enterprise.

New Technology Transfer Agreements

In FY 2007, NNSA and its Complex negotiated and executed 405 new technology transfer – related agreements. These transactions include 78 new CRADA's and 327 new WFO projects involving Non-Federal Sponsors (NFS).

Patents and Licenses

The NNSA Complex issued 287 licenses to include patent licenses, commercial patent licenses, commercial copyright licenses and hybrid licenses. In addition, NNSA had 483 patent applications. A total of $12M was reported for Licensing income in FY 2007.

WFO NFS Funding

Associated with these activities, the NNSA Complex reported $88M in estimated funding for new WFO NFS agreements and $97M in actual funds received for all active WFO NFS agreements.

CRADA Funding

The DOE/NNSA Federal contribution for new CRADAs was estimated at $17M, with an estimated $44M “funds-in” from private industry for new CRADAs, and $82M in-kind received from private industry. (Charts 1 through 3).

To further demonstrate the vibrancy of the NNSA technology transfer program, the following table highlights some significant success stories for the NNSA Technology Transfer Program. Further elaboration of these success stories is provided in Appendix

SUCCESS STORIES BY FACILITY		
FACILITY	**TECHNOLOGY**	**DESCRIOTION**
LLNL	Large Area Imager	• Improves ability to detect, locate and identify sources of radioactivity over large land masses.
	Proton Beam Therapy	• Dielectric Wall Accelerator(DWA) developed to increase the effectiveness of Proton beam Therapy • Technology will make PBT more readily available to cancer treatment centers
LANL	New Generation Radiation Detector	• Small ,portable multiplicity shift register for detection of plutonium and other radioactive materials for use in homeland security
	Conversion of natural gas waste into liquid fuel utilizing sound waves.	• Convert natural gas waste into liquid fuel.
	Avian Flu Modeling and Simulation Software.	• Models the pandemic at the individual human level using the most current data on spread of pathogens in human populations.
SNL	T1-A Optical Seal and Secure Sensor Platform.	• The T-1A optical seal sensor utilizes radio frequency to make it highly difficult to remove material or containers without breaking the seal. • Effective security system for maintaining special nuclear material storage areas.
	Self assembling Process for for fabrication thin films	• Simple economical nanotechnology coating process for the development of nano particle thin films. • Resolves the following issues associated with conventional processes: cost, logistical, environmental safety and health.
	Electron Needle Biomedical Sensor Array	• When pressed against skin the device will provide rapid, on demand, multiplexed point of care biomedical assays for medical diagnosis in emergency, battlefield, and remote settings.
SRNL	Pro- Tec Tear offs	• Incorporates use of thin multilayered sheets of mylar film applied directly to surfaces for contamination control. • Significant advantage is reduction of waste volume.
Y-12 PLANT	Ferret Technology License	• Developed for Y-12 National security Complex to help classification personnel analyze and classify sensitive documents.

NNSA LABORATORIES, PLANTS, AND TEST SITE FACILITIES

This section highlights specific technology Transfer objectives and accomplishments for each laboratory, plant and site during FY 2007.

Lawrence Livermore National Laboratory (LLNL)

A. Introduction

The Industrial Partnerships and Commercialization Office (IPAC) has two fundamental missions. One is to transfer technology to the private sector for public use and benefit, while enhancing U.S. economic competitiveness and development. A second, and equally important mission is to support LLNL's programmatic objectives by jointly developing technology with industry or transferring technology to establish a vendor base for our programs. IPAC seeks to accomplish its technology transfer missions in a manner that is exemplary by maintaining operating processes and procedures that are consistent with statutory requirements and with DOE and NNSA guidelines.

B. Objectives

FY2007
The objectives for IPAC in FY07 continued to be to carry out our mission of transferring technology to the private sector for public use and benefit, while generating revenue for the laboratory and maintaining our alignment with the laboratory's programmatic needs. An important objective for FY07 has been to continue and expand our participation in the development of partnerships to meet national needs.

FY2008
FY 2008 will be a time of transition for LLNL's industrial partnering program. The laboratory's Management & Operating Contractor will for the first time be a for-profit entity, Lawrence Livermore National Security (LLNS), LLC; and we look forward to continuing and expanding our successful initiatives under the LLNS contract. The Industrial Partnerships and Commercialization Office will change its name to Industrial Partnerships Office (IPO) to better reflect the breadth of our activities and the partnering successes that we anticipate under the LLNS contract. Our objectives for FY08 and beyond include meeting significant contract deliverables related to technology partnering and transfer while we continue our successful initiatives and pursue new opportunities.

C. Areas for Improvement

During FY08 and beyond, we plan to increase our outreach to the small business and venture investing communities; to explore new and more effective partnering mechanisms for large and small companies; to work more closely with LLNL programs to develop strategic technology lists and roadmaps for laboratory programs; and to identify prospective commercialization

partners and companies with special capabilities to contribute to meeting the laboratory's larger goals and objectives.

D. Energy Policy Act (EPAct) of 2005

An important focus of the Energy Policy Act is assistance to small business. IPAC has traditionally worked actively with small business, particularly in our CRADA and licensing programs. Several of our initiatives described in this document, will operate to directly benefit small businesses by fostering their establishment or by facilitating partnerships with the laboratory. Specifically, during FY08 and beyond, our office plans to increase its outreach to the small business community through our activities with local business councils and venture investing organizations by the establishment of an entrepreneur program for employees wishing to start companies based on laboratory-developed technology, and our development of plans for a technology incubator and/or accelerator.

Sandia National Laboratories (SNL)

A. Introduction

At the end of FY2007, Sandia realigned the functions of the Strategic Relationships Center, Sandia's technology transfer and partnership development organization. The technology transfer and partnership development functions were decentralized and divided among a set of existing and newly created organizations. Overall programmatic responsibility for the technology partnership program now resides in the Industrial Partnerships and Strategies organization, which reports to Sandia's Vice President for Science, Technology, and Research Foundations.

B. Objectives

FY2007
The following are Sandia's Technology Partnership Program objectives:

- Support Sandia's missions;
- Commercialize Sandia's technologies;
- Support job creation and small business development; and
- Support the Strategic Management Units (SMUs) in revenue generation.

FY2008
Objectives for upcoming years will include those above plus the following:

- Support implementation of EPAct 2005 Title X, Sec. 1001 requirements, as directed by DOE; and
- Create and implement a Strategic Industry Engagement plan to support business development needs with a strong Science, Technology and Engineering content.

C. Areas for Improvement

- Agreement improvement efforts are underway as part of NNSA's Work For Others (WFO) Complex 2030 strategy development and future activities to support the newly created Technology Transfer Working Group (TTWG) and the Technology Transfer Policy Board. Sandia will continue to work with NNSA and DOE to identify modifications and streamline NNSA technology transfer/partnerships policies, processes, and procedures, including improvements to technology transfer mechanisms.
- Review current licensing and Entrepreneurial Separation to Transfer Technology (ESTT) policies to evaluate and manage risks.

D. Energy Policy Act (EPAct) of 2005

Our efforts to implement requirements of EPAct 2005 as directed by DOE will include:

- Active participation in DOE's TTWG supporting the DOE's Technology Transfer Policy Board; and
- Participation in DOE/Energy Efficiency and Renewable Energy (EERE) pilot Entrepreneur-in-Residence (EIR) and Technology Commercialization Development Fund (TCDF) programs, including hosting a venture capital company's EIR at Sandia and implementing several TCDF activities in cooperation with industry.

Savannah River National Laboratory (SRNL)

A. Introduction

Implementation of Technology Transfer Programs at the Savannah River Site (SRS) is the responsibility of the Technology Transfer & Business Integration Section (TT&BI). TT&BI is part of the Business Development Department within the Savannah River National Laboratory (SRNL). SRNL is one of multiple business units under the direction of Washington Savannah River Company (WSRC), LLC, the Management and Operating Contractor for the Department of Energy at the SRS.

TT&BI areas of responsibility are diverse and include administration functions that support the management of SRNL. Funding for the technology transfer programs are provided through General and Administrative accounts. Currently thirteen employees are assigned to TT&BI with responsibilities that include management of IP, management of technology license agreements, and management of all Technology Transfer mechanisms (CRADA, WFO, and university partnership agreements).

B. Objectives

FY2007
During FY 07, associated staffing was reduced while work scope was substantially increased. To address this challenge, considerable effort was applied to process improvements and the establishment of best practices. TT&BI's challenge has been and will continue to meet our customer's needs and expectations during a time of dynamic change. During the year, focus was

directed upon improvements in management and maintenance of IP and TT mechanisms and expanding university teaming.

FY2008
FY 08 objectives will focus on expanding program visibility within and outside the laboratory, streamlining processes for CRADA and WFO mechanisms and establishing metrics for the technology transfer program.

C. Areas for Improvement

Increased depth is needed to provide back up for key functions, and the number of external partnership, agreements, and WFO's is increasing, resulting in increased demand for legal, contractual, and administrative support.

D. Energy Policy Act (EPAct) of 2005

During FY 07, SRNL began active participation in the new Technology Transfer Working Group (TTWG) as well as the NNSA Working With Others Executive Board. This involvement contributed to ongoing efforts in streamlining technology transfer mechanisms for executing agreements and consistency with other laboratories in implementing related requirements.

Los Alamos National Laboratory (LANL)

A. Introduction

Los Alamos National Laboratory, Technical Transfer (TT) Division enhances the laboratory's mission by partnering with industry, accelerating the creation of products and services from Los Alamos discoveries, and by fostering a regional entrepreneurial economy. The TT Division serves as a primary bridge between one of the nations leading science laboratory and the commercial world. Responsibilities include the management and implementation of partnerships, commercialization and licensing mechanisms and processes, as well as the management and implementation of Intellectual Property. The department develops strategic partnerships with industry and markets and promotes these opportunities. The department actively strives to foster a culture that rewards innovation and creates forward thinking programs such as; 1) Technology Maturation Fund, 2) Industrial Fellowship Program, 3) Visiting Entrepreneurs, and 4) MBA Summer Internships.

B. Objectives

Each year, Los Alamos TT Division establishes outcome and process improvement goals for the upcoming fiscal year, focuses on a desire to maintain a steady upward trend in general revenue, and to support laboratory programmatic missions and numbers of regional companies founded based upon laboratory technology. With regard to process goals LANL continues to improve all business practices; but annually those practices are targeted, which fall within the critical path for outcome goal achievement.
FY2007

The laboratory will continue to focus upon expanding the execution of new licensing and R&D agreements with industry as well as encouraging scientists to seek competitive grant proposals to Federal Agencies. Work will continue with local entrepreneurs and venture capitalists and the TT division will conduct process improvements in IP management and agreement processing.

C. Areas for Improvement

During the upcoming years, the laboratory will address the need for improvements in information management systems related to technology availability. There will also be a focus to improve the area of conflict of interest, making the policy more transparent to the laboratory community, allowing management to more effectively address the issues.

D. Energy Policy Act (EPAct) of 2005.

LANL has established a baseline for activity related to "applied energy research, development, demonstration and commercial application" carried out in FY 06. This baseline confirmed that the laboratory had been in compliance with the EPAct mandate of 0.9 % of DOE funds used toward technology commercialization. In addition, the laboratory has actively participated in the Technology Transfer Work Group (TTWG) directed by the EPAct.

Y-12 National Security Complex (Y-12)

A. Introduction

Technology Transfer for Babcock & Wilcox Technical Services Y-12, L.L.C. ("B&W Y-12") is an activity conducted by the Office of Technology Transfer (OTT).

OTT is funded as a small office managing all aspects of technology transfer. This includes identification and protection of intellectual property, filing of patent applications, maintaining issued patents, negotiating, executing and managing licenses, developing and executing Cooperative Research and Development Agreements (CRADAs), and use of technology transfer as a strategic tool in meeting Y-12 National Security Complex mission objectives.

B. Objectives

FY2007
OTT had the following strategic objectives for FY 2007:

- Identify, report, perfect and protect intellectual property (inventions, patents, copyrights, and trademarks). (Articles I.80 and I.166 of the Prime Contract)
- Leverage intellectual property to support Y-12's mission
- Create revenue streams for Y-12 from royalties received from licenses
- Promote funds-in sponsor research agreements in conjunction with the licenses (Complementary Work and CRADAs)
- Utilize revenue streams to help meet Y-12's strategic objectives

FY2008
It is believed that the potential for a number of important opportunities for DOE/industry partnerships will develop at Y-12 in FY 2008, including the licensing of microwave and nano-related technologies. It will be important to concentrate on the most productive and beneficial prospects for licensing these inventions. As success is achieved it is anticipated that additional resources may be justified to take advantage of expanding opportunities. The creation of the Y-12 Uranium Center of Excellence (UCE) has provided increased drive and focus on technology transfer activities.

C. Areas for Improvement

Areas of improvement will be focused on processes concerning the maintenance and protection of intellectual property and streamlining the processes and mechanisms of technology transfer for commercialization.

D. Energy Policy Act (EPAct) of 2005.

Supporting TITLE VI-Nuclear Matters, Subtitle D-Nuclear Security, Sec. 651., nuclear facility and materials security;
Supporting TITLE VI-Nuclear Matters, Subtitle D-Nuclear Security, Sec. 653. Use of firearms by security personnel;

- Patents have been applied for in both of these areas in support of nuclear security issues.
- Efforts are being made to reach out to the private sector to share the many technologies developed at Y-12.
- Websites have been updated to make information available concerning these technologies and provide assistance to those who subscribe.
- There have been a number of non disclosure agreements exercised to begin negotiation for potential opportunities of Technology Transfer to industry.

Pantex Plant (PX)

A. Introduction

The Reimbursable/Work for Others (WFO)/Technology Transfer Program at Pantex is small; however, this has been the NNSA management philosophy and decision to keep it small so as not to interfere with demanding deliverables that are performed in the primary mission for the NNSA. Nuclear weapons dismantlement has been increased over last fiscal year's level (FY06) by 146 percent, according to NNSA Administrator, Thomas D'Agostino, NNSA Monthly News, Nov/Dec 2007 issue. With this incredible increase, this is the focus of the Pantex workload. Therefore, not much excess capacity exists to conduct Technology Transfer projects.

B. Objectives

FY2007
There were no objectives for commercialization in FY07 due to the unique primary mission at B&W Pantex for the NNSA. All work performed for others outside of Pantex are considered "Reimbursable Work." This included projects for outside agencies, both Federal and Non Federal.

FY2008
The Reimbursable/WFO/Technology Transfer Program at Pantex will remain at about the same level in FY08 as it was in FY07. Pantex will not grow the Technology Transfer Program unless ordered to by the NNSA Administrator.

C. Areas for Improvement

B&W Pantex could possibly provide more WFO/Technology Transfer in other areas of expertise such as Intellectual Property (IP), Nuclear Incident Response Program and Applied Technology; however, this would require additional human resources.

D. Energy Policy Act (EPAct) of 2005

B&W Pantex is in compliance with all requirements as identified within the Energy Policy Act of 2005.

E. Efforts in Technology Commercialization

Due to the unique primary mission at B&W Pantex for the NNSA, efforts in Technology Commercialization would be extremely difficult. With the highly sensitive and areas of 'High Security' where most of the advanced Technology is located make it virtually impossible for commercialization or to be competitive within the U.S.

Kansas City Plant (KCP)

A. Introduction

The Kansas City Plant is a Department of Energy production facility. The facility is managed and operated by Honeywell Federal Manufacturing & Technologies (FM&T) LLC. The work is administered by the National Nuclear Security Administration (NNSA), Office of Defense Programs. The primary mission assignments of the KCP are to support the requirements of the DOE's Stockpile Stewardship Program by producing authorized quantities of non-nuclear weapon components, maintenance of manufacturing capability to meet the stockpile maintenance requirements of the enduring stockpile, and to participate and support the advanced development activities of the NNSA. In order to ensure the full use of the results of research and development efforts and the capabilities of the weapon production facility, technology transfer is also established as a mission of the KCP.

The Technology Transfer mission related to partnership collaborations is managed through the Office of Business Partnerships (OBP). The Contracts Manager oversees contract activities such as CRADA's, WFO, and User Facility Agreements, as well as program activities such as the Initiatives for Proliferation Prevention (IPP) Program. The Technology Transfer mission related to intellectual property evaluation and licensing is managed out of the Department of Stockpile Technology and Surveillance (STS) which is responsible for technology development planning and execution through the Campaign and Plant Directed Research and Development (PDRD) programs.

B. Objectives

The Kansas City Plant will continue to integrate Technology Transfer programs with its primary mission to support the requirements of the DOE Stockpile Stewardship Program and compliance with all DOE Technology Transfer orders. Technology Transfer opportunities will be addressed through the use of:

- CRADA agreements,
- Partnerships funded by Campaign, Program or PDRD,
- Work For Others (WFO),
- User Facilities, and.
- Licensing of Intellectual Property.

C. Areas for Improvement

The OBP will manage and oversee training programs that may be required to facilitate the management of and growth opportunities for technology partnership projects implemented through any of the TT mechanisms described.

D. Energy Policy Act (EPAct) of 2005

KCP has actively participated in the Technology Transfer Work Groups established through the Energy Policy Act of 2005.

Nevada Test Site

The Technology transfer Program at NTS is small due to the nature of the mission accomplished at the NTS and limited staffing allocated to technology transfer. We encourage this activity to the maximum extent feasible. However there are only a limited number of Technology Transfer/Industrial Partnering opportunities available at NTS. We will continue to monitor our environment for any opportunities to increase the extent of Technology Transfer/Industrial Partnerships at NTS.

Chart 1 - FY 2007 Cooperative Research and Development Agreement (CRADA) Data

FY-07 CRADA Funding ($M)	**LANL**	**LLNL**	**SNL**	**NTS**	**KCP**	**PX**	**SRNL**	**Y-12**	**Totals**
New NNSA Funds	$0.059	$3.515	$1.395	$0	$0.895	$0	$0	$0.490	$6.354
New Non-NNSA Funds (DOE, etc.)	$0.152	$0.009	$7.276	$0	$0	$0	$3.150	$0	$10.587
New Partner Funds-in	$17.200	$15.978	$10.447	$0	$0	$0	$0.030	$0	$43.655
New Partner In-Kind	$28.100	$20.634	$31.084	$0	$1.000	$0	$0.940	$0.460	$82.218
Total Planned Funding for New CRADAs (over life of CRADA)	$46.100	$40.136	$50.202	$0	$3.500	$0	$4.580	$0	$144.518
Actual Govt. Funds-in FY-07 Active CRADAs	$2.300	$2.407	$5.080	$0	$3.500	$0	$0.260	$0.267	$13.814
Actual Funds-in in FY 07 Active CRADAs	$12.100	$4.142	$21.326	$0	$0	$0	$0.390	$0	$37.958
Number of CRADAs	**LANL**	**LLNL**	**SNL**	**NTS**	**KCP**	**PX**	**SRNL**	**Y-12**	**Totals**
New NNSA	1	4	2	0	2	0	0	1	10
New Non-NNSA (DOE, etc.)	3	0	6	0	0	0	1	0	10
New 100% funds-in	20	8	30	0	0	0	1	0	59
Total New CRADAs	24	12	37*	0	2	0	2	1	78
Total Continuing CRADAs	47	26	111	0	5	0	8	0	197
Total Active CRADAs	71	38	148*	0	7	0	10	1	275

*One new SNL CRADA is funded with both NNSA funds and non-NNSA (OFA) funds but is not double counted in the "Total New CRADAs" and "Total Active CRADAs"

Chart 2 - FY 2007 Intellectual Property (IP) and Licensing Data

FY07 IP/Licensing Data	LANL	LLNL	SNL	NTS	KCP	PX	SRNL	Y-12	Totals
Total New Patent Applications	130	198	122	0	10	0	13	10	483
Newly Executed Patent Licenses	30	16	11	0	0	0	4	1	62
Continuing Patent Licenses	124	69	352	4	3	0	9	19	580
Total New Commerical Patent Licenses	27	16	9	0	0	0	4	0	56
Total Active Commercial Patent Licenses	108	85	103	0	3	0	13	20	332
Total New Commercial Copyright Licenses	6	87	60	0	0	0	0	0	153
Total Active Commercial Copyright Licenses	1111	255	680	1	1	0	1	10	2059
Total New Hybrid Licenses	0	3	2	0	0	0	1	0	6
Total Active Hybrid Licenses	0	10	66	0	0	0	2	0	78
Total Licensing Income ($M)	$1.583	$6.300	$4.094	$0	$0.111	$0	$0.053	$0.127	$12.268

Chart 3 - FY 2007 Work-For-Others (WFO) Non Federal Sponsor (NFS) Data

FY-07 WFO-NFS Data	LANL	LLNL	SNL	NTS	KCP	PX	SRNL	Y-12	Totals
New Agreements	42	82	93	1	38	38	9	24	327
Continuing Agreements	125	253	173	5	85	14	17	44	716
Estimated Funding for New Agreements (all years) ($M)	$5.500	$55.800	$22.628	$0.038	$0.700	$1.700	$0.590	$1.190	$88.146
Actual Funds Received for all Active Agreements in FY-07 ($M)	$17.900	$33.900	$33.310	$2.483	$1.500	$3.800	$3.900	$0.227	$97.020

Appendix C:

Selected Technology Transfer Accomplishments

There are many examples of technology transfer and industry partnering activities that reflect successful programs at DOE national laboratories and facilities. The following are brief descriptions of successes from FY 2007 and FY2008. These examples illustrate the nature and range of technology transfer activities across the complex.

- Aviation Flu Monitoring and Simulation Software
- Burying Global Warming with SEQURE™ Well Finding Technology
- Cadmium Telluride (CdTe) Photovoltaic (PV) Technology
- Cool Color Roofs
- Counterintuitive Combustion Technology
- Customized Coating For Enhanced Water Sampling
- ElectroNeedle™ Biomedical Sensor Array
- Electro Optic Voltage Sensor System
- Enhancing Advanced Coal Technologies with Multiphase Flow with Interphase eXchanges (MFIX)
- Foam-Based Decontamination
- Making Proton Therapy More Accessible to Cancer Patients
- Managing Heat and Water in Fuel Cells
- Midwest Forensics Resource Center
- Modified Cast Stainless Steel, CF8C-Plus
- Near-Frictionless Carbon Coating
- New Advancement in Ferret Technology
- New Radiation Detectors
- Next Generation Logistics Planning and Technology
- Noninvasive Pneumothorax Detector
- Novint Falcon and Novint/Sandia 3D-Touch Software
- Powertrain System Analysis Toolkit
- T7 Gene Expression System
- High-Power Battery for Hybrid Electric Vehicles
- Antibody Profiling Identification
- Motion to Energy Power Generation System
- Stun Baton
- Muon Tomography
- Protein Analysis using the Green Fluorescent Protein Toolbox
- Solid Electrolyte for Rechargeable Lithium Batteries
- PhyloChip Tracking of Bacterial Dangers
- Fission Meter: High-Sensitivity, Advanced Portable Neutron Source Identification System

- Advanced Cargo Container Security System
- Advanced Process Engineering Co-Simulator (APECS) software
- Advanced Optical Furnace Technology
- Concentrating Photovoltaic (CPV) System
- Diagnostics and Treatments for Certain Human Diseases of Cartilage and Vertebral Disc Growth, Cardiac repair, and Skeletal Muscle Regeneration
- High-Intensity Arc-Discharge Lamp
- Inexpensive Fuel Cell Catalysts
- Active Radio Frequency-Based (RF) Optical Seal
- Ultracold Refrigeration
-

TECHNOLOGY TRANSFER

SUCCESSES

FY2007

Avian Flu Modeling and Simulation Software

Santa Fe-based CIVA (The Company for Information Visualization and Analysis) signed an agreement to license Los Alamos National Laboratory's (LANL) epidemiological modeling and simulation system, EpiCast. EpiCast models pandemics at the individual human level using the most current data on the natural and deliberate spread of pathogens in human populations. It helps epidemiologists understand the spread and impact of an Avian Influenza (H5N1) pandemic.

The computer simulation models a synthetic population by matching available census demographics and worker mobility data and by randomly assigning the simulated individuals to households, workplaces, schools, and etcetera. The simulation also uses travel data to model long-distance trips and realistically captures the spread of the pandemic virus by airplane and other passenger travel. Additionally, the model involves probabilities that any two people in a population will meet on any given day in any number of settings, for example, at home or in the workplace.

Other elements modify the simulated disease course as well. For example, a significant fraction of people infected with the pandemic influenza never develops clinical symptoms even though they themselves are infectious. In addition, the durations of the incubation and infectious periods vary and in the simulation model are randomly chosen from distribution functions for each individual, involving more throws of the virtual dice. With its unprecedented level of detail, EpiCast has been used to evaluate various medical and non-medical mitigation strategies in the event of a pandemic influenza outbreak in the United States.

CIVA plans to run these flu-impact models for government, public, and private organizations, providing customers with modeling results derived from the software rather than from the software itself. While for-profit enterprises will be charged a fee for this service, the cost to subsidize nonprofit organizations and agencies will come from nonprofit endowments, government grants, and nongovernmental organizations.

"We feel we have a responsibility to humanity to disseminate the modeling as widely and as fast as possible," said Dr. L. Robert Libutti, CIVA chairman. "We are making every effort to make EpiCast available to any and all organizations that could benefit from the insight the model affords."

The United States map representing day 80 of a pandemic if no actions are taken to slow the spread of disease prior to the outbreak.

Burying Global Warming with SEQURE™ Well Finding Technology

SEQURE™ Well-Finding Technology was developed by National Energy Technology Laboratory (NETL) researchers Richard Hammack and Garret Veloski in partnership with Apogee Scientific, Inc. (Englewood, Colorado), Fugro Airborne Surveys (Mississauga, Ontario), and LaSen, Inc. (Las Cruces, New Mexico).

By way of background, geologic sequestration stores the CO_2 greenhouse gas in geologic formations, such as depleted oil and gas reservoirs, and is a critical step towards curbing the effects of global warming. Those formations must subsequently be evaluated to make sure they are properly sealed and suitable for the task. SEQURE™ locates wells quickly and efficiently, allowing researchers to pinpoint the most reliable reservoirs to help bring global warming to a halt, and thus constitutes a major breakthrough in carbon sequestration efforts.

If you've ever re-used jars to can your own vegetables, this approach will sound familiar. Oil and gas are trapped under ground and under pressure for millions of years until engineers extract these hydrocarbons to feed our energy needs. What remains are-usable containers capable of indefinitely storing the byproduct of our fossil fuel use, CO_2. While this sounds easy enough, the caprock (think lid) of the hydrocarbon cans was punctured in 1859 and today is now perforated with millions of wells. If the holes can be patched and the wells made into air-tight vessels once again, depleted hydrocarbon reservoirs would be the perfect place for CO_2 storage. In many cases, however, the abandoned wells leak. Cement that was used to plug the wells degrades over time or was never made completely air tight to begin with. Improperly plugged wells would release the CO2 stored in the reservoirs and such wells are considered the greatest threat to carbon storage.

The solution? Find and check every abandoned well to ensure that all potential leak points are sealed. And that's no small task. Over time, many wells have become buried. In some cases, parking lots have even been built over them.

SEQURE™ provides a speedy way to locate the wells, which are spread over miles, so that ground teams can more efficiently evaluate them. SEQURE™ deploys helicopters loaded with magnetic and methane sensors to locate lost wells—a search that stretches over hundreds of square kilometers. It saves time, is cost-effective, and is the only commercially available well-finding technology for large areas. SEQURE™ was recognized by *R&D Magazine* with a 2007 R&D 100 award.

A helicopter affixed with SEQURE™ technology hovers in the sky above Salt Creek Oilfield in Wyoming. By attaching to highly mobile airborne vehicles, SEQURE™ can cover large areas to quickly locate abandoned and leaking wells using magnetic and methane sensors.

Cadmium Telluride (CdTe) Photovoltaic (PV) Technology

In February 2007, the National Renewable Energy Laboratory (NREL) and PrimeStar Solar, Inc. signed an $870,000 Cooperative Research and Development Agreement (CRADA) to transition NREL's leading cadmium telluride (CdTe) photovoltaic (PV) technology to commercial module production. This technology, developed at NREL, produces the world record CdTe PV cell efficiency of 16.5 percent.

In addition to technology transfer, the CRADA provides PrimeStar Solar with ready access to NREL's world-class photovoltaic scientists and state-of-the-art equipment. PrimeStar Solar has leased a 16,000 square foot facility near NREL in Golden, Colorado, to develop a pilot plant. Initial CdTe processing equipment has been delivered from PrimeStar's assembly facility in Michigan.

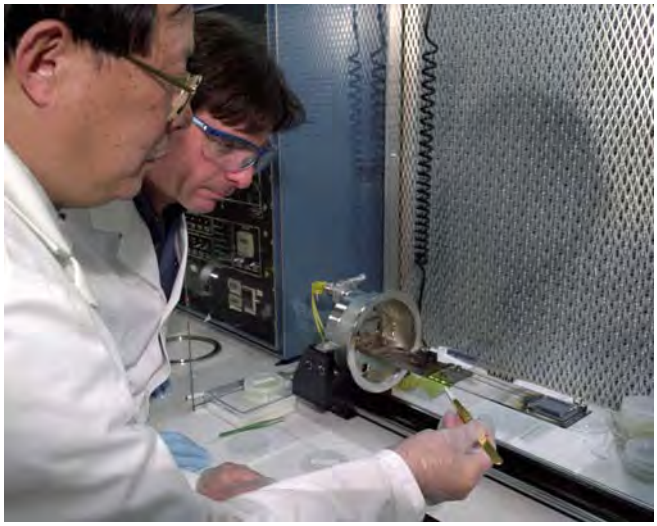
PrimeStar Solar secured seed capital in excess of $6M from individual investors and a global investment bank to help fund a portion of the initial scale-up work. The company plans to rapidly scale up low-cost CdTe PV module production.

NREL has been researching, developing, and helping to commercialize CdTe technology for several years. In 2003, NREL researchers shared an R&D 100 Award with First Solar for developing a high-rate vapor deposition technology that deposits a thin, uniform layer of CdTe or cadmium sulfide over a glass substrate in less than 40 seconds. This technology revolutionized thin-film, PV module production.

NREL's CdTe PV technology research and development supports the U.S. Department of Energy's (DOE) Solar America Initiative. This initiative strives to make solar energy cost-competitive with conventional forms of electricity by 2015. The strategy pursues complementary activities in research and development, and in market transformation. The goals are to reduce costs through research and development, and to eliminate market barriers through deployment.

It also supports NREL's mission to develop renewable energy and energy efficiency technologies and practices, advance related science and engineering, and transfer knowledge and innovations to address the nation's energy and environmental goals.

NREL is operated under contract to the DOE Office of Energy Efficiency and Renewable Energy (EERE) by the Midwest Research Institute and the Battelle Memorial Institute.



NREL researchers test a cadmium telluride PV cell. Credit: Warren Gretz. NREL PIX # 10822

Cool Color Roofs

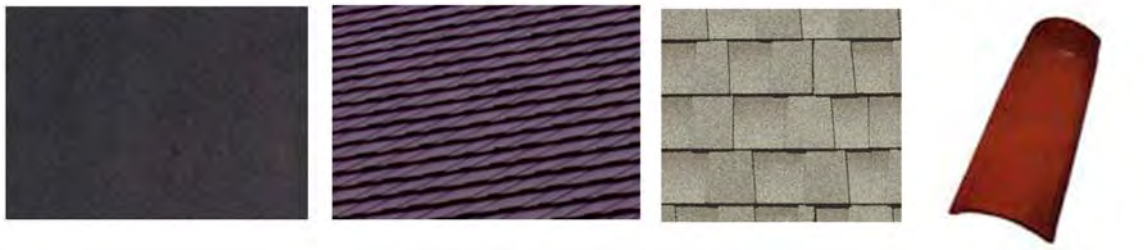
Many American homeowners will not buy light colored roofs, even if they reduce air conditioning bills by reflecting, instead of absorbing, solar heat, for aesthetic reasons. Thus, the question for scientists who are interested in increasing energy efficiency is: Can one make a roof that is both cool and dark?

Hashem Akbari, Paul Berdahl, and Ronnen Levinson of Lawrence Berkeley National Laboratory (LBNL) and their collaborators in U.S. industry tackled this very question with breakthrough results. They created a toolkit—Cool Color Roofs—a database, software, and a novel manufacturing method for developing heat-reflective roofing products in any color, dark or light. Cool Color Roofing uses pigments that have high "solar reflectance" – the ability to reflect solar radiation in the visible and near-infrared part of solar spectrum – making energy-saving roofing available in a wide range of colors. LBNL estimates that applying cool-colored roofs to residences in U.S. cities could achieve a net energy savings in the U.S. worth over $400 million per year.

The LBNL scientists used solar spectrometers to identify pigments of different colors that reflect the near-infrared component of sunlight and wrote software for the design of cool color coatings to develop Cool Color Roofs. They collaborated with a consortium of U.S. pigment, coating and roofing manufacturers to develop novel methods to manufacture asphalt shingle, clay tile, concrete tile, and metal roofing in a wide palette of cool colors. The consortium includes most of the major roofing manufacturers.

LBNL's industrial partners manufactured the prototypes and products, while colleagues at Oak Ridge National Laboratory (ORNL) performed some of the demonstration work, measuring both the energy savings achieved by the use of cool colored roofing, and the extent to which exposure over time changes its appearance and performance. All of LBNL's sixteen industrial partners have already introduced or plan to introduce cool color roof products or components in their product lines.

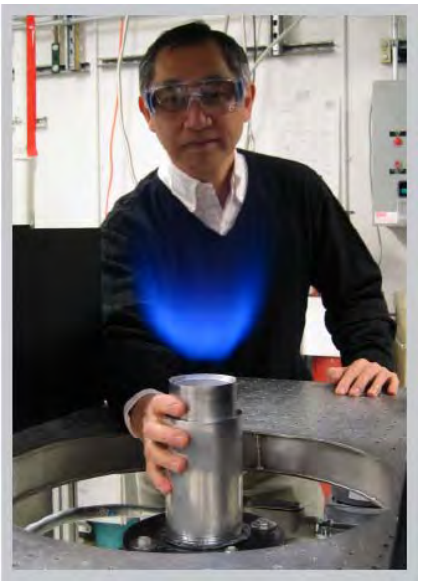
The price differential between cool roofs and conventional roofing is typically paid back in air conditioning savings within a few years. Cool Color Roofing reduces a home's solar heat gain in a warm climate by 10 to 20%; these roofs also lower a home's peak-hour cooling power demand by about 10 to 20%, helping prevent blackouts and brownouts on hot summer afternoons. In addition, when a sufficiently large number of home and commercial building owners adopt cool roofs regionally, urban air temperatures will decrease, slowing the rate of smog formation.



"Cool color" concrete tile, metal, asphalt shingle, and clay tile roofing products based on LBNL technology. Left to right: American Rooftile Coatings, Custom-Bilt Metals, GAF/Elk, and MCA Clay Tile (Photo credit: Lawrence Berkeley National Laboratory)

Counterintuitive Combustion Technology

Combustion is one of the earliest chemical processes studied by humans. A few years ago a researcher at Lawrence Berkeley National Laboratory (LBNL) stood combustion theory on its head to develop an ultralow NOx emissions combustion technology for gas turbines that significantly reduces greenhouse emissions and pollution from electricity production.



Inventor Robert Cheng and the Berkeley Lab Low Swirl Injector. (Photo credit: Lawrence Berkeley National Laboratory)

LBNL's combustion technology, called the Low Swirl Injector (LSI), emits less than 2 parts per million (PPM) NOx – almost 10 times less than state-of-the-art burners. Other benefits of Berkeley Lab's low swirl technology include its scalability and fuel flexibility. Gas turbines of all sizes that employ LSI technology can burn a variety of gaseous hydrocarbons including natural gas, liquefied natural gas, petroleum production and refinery gases, waste gases, and biogases and still meet the stringent < 2.5 ppm NOx emission limit that EPA has set for non-attainment areas in the US.

"The LSI principle defies conventional approaches," says LSI inventor Robert Cheng. "Combustion experts worldwide are just beginning to embrace this counter-intuitive idea. Principles from turbulent fluid mechanics, thermodynamics, and flame chemistry are all required to explain the science underlying this combustion phenomenon."

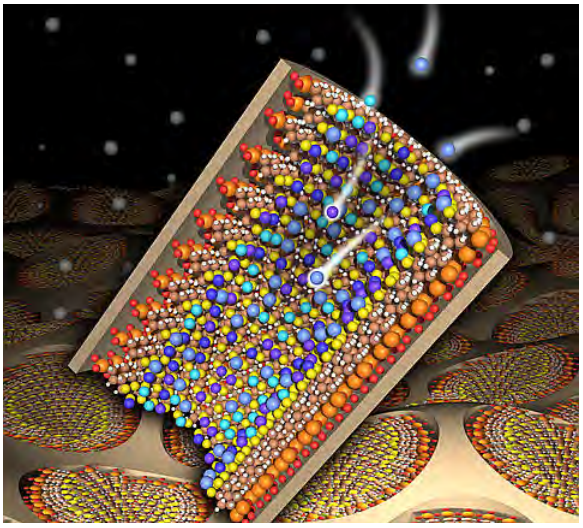
LBNL's low NOx combustion technology has already hit the market place in the product line of industrial burners sold by Maxon Inc. The technology also is being developed in several collaborative projects for use in turbines that burn a variety of fuels.

The Department of Energy (DOE) initially funded the development of Berkeley Lab's LSI for use in industrial gas turbines for distributed electricity production. The purpose of this research was to develop a natural gas-burning turbine using the LSI's ability to substantially reduce NOx emissions. Later, Cheng, Berkeley Lab colleague David Littlejohn, and Kenneth Smith and Wazeem Nazeer from Solar Turbines Inc. of San Diego adapted the low-swirl injector technology to the company's Taurus 70 gas turbine that produces about seven megawatts of electricity.

A collaborative effort by Berkeley Lab and the National Energy Technology Laboratory (NETL) in Morgantown, WV, has taken the technology even further. The group successfully test fired an LSI unit that used pure hydrogen as fuel in July. In addition, DOE's Office of Fossil Energy is funding a project in which the LSI is being tested for its ability to burn syngas (a mixture of hydrogen and carbon monoxide) and hydrogen fuels in an advanced Integrated Gasification Combined Cycle (IGCC) plant called FutureGen. FutureGen is planned to be the world's first zero-emissions coal power plant.

Customized Coating for Enhanced Water Sampling

Pacific Northwest National Laboratory (PNNL) has developed an innovative technology to coat the surface of silver-dollar-sized “sampler” discs used in detecting heavy metals in aqueous environments. This technology provides the mechanism to increase selectivity and detect nearly every class of heavy metal that is harmful to human health.



Functionalized Nanoporous Thin Films is a new sorbent material designed to preconcentrate heavy metals in water, creating samplers that increase detection sensitivity of x-ray fluorescence spectroscopy by a thousand times

Functionalized Nanoporous Thin Films (FNTF) is a simple and inexpensive detection technology that allows for customized analysis. Since even low concentrations of heavy metals such as mercury, cadmium, and lead in water can cause serious harm to human health, it is important to regularly assay drinking water sources, rivers, lakes, and streams. Current testing methods for heavy metals in water are complicated and expensive. However, FNTF offers a new, low-cost, highly-selective and more sensitive method for heavy metal testing.

X-ray fluorescence spectroscopy (XRF) coupled with FNTF gives water testers an easy-to-use technology that removes the requirement for complex chemical pre-treatment and handling of liquid samples needed for current heavy metal assay methods.

PNNL partnered with PANalytical B.V., the world’s leading supplier of analytical instrumentation and software for XRF, to develop and test the FNTF-coated samplers on XRF performance. By preconcentrating the trace elements onto the FNTF’s porous surface, the sampler presents a near-solid sample for the XRF instrument to analyze, thereby improving its performance and lowering its detection limits by a factor of a thousand or more. PANalytical is now able to offer its customers XRF analysis for heavy metals in water and other liquids, an area in which XRF could not compete before incorporating FNTF into the process.

Samplers can be preconcentrated at the sampling site and then packaged individuallly for transport back to a laboratory for analysis. Dozens of sampler discs can fit into a water-sampling kit the size of a small fishing tackle box, unlike the current sampling methods utilizing heavy ice chests filled with pretreated water samples in containers. Furthermore, unlike actual water samples, the preconcentrated sampler discs can be stored for an indefinite period of time without deterioration of the sample; this provides for a reliable forensic archive. The ease of sampling and the low cost of the sampler discs broaden the XRF market for heavy metal assay to include home water-sampling kits that can be mailed by the user to a testing laboratory for XRF analysis.

ElectroNeedle™ Biomedical Sensor Array

Product developer Jeb Flemming holds a test version of the ElectroNeedle™ device.

Sandia National Laboratories (Sandia) has developed the ElectroNeedle™ Biomedical Sensor Array, a device that, when pressed against the skin, provides rapid, on-demand, multiplexed, point-of-care biomedical assays for medical diagnosis in emergency, battlefield, and remote settings where time constraints or distance make it impractical to send the patient's samples to a conventional laboratory for analysis. It will also eliminate delays experienced by many patients and physicians in waiting for diagnostic test results. Finally, it will enable a new dimension in home healthcare, in which patients can be routinely monitored and also have their results transmitted to a physician.

By combining electrochemical measurement techniques with well-defined recognition chemistries and an easy-to-use sensor, it is possible to detect a range of biologically important species, including carbohydrates, electrolytes, lipids, enzymes, toxins, proteins, viruses, and bacteria, in a patient's blood or cellular fluid. This technology provides a painless and rapid measurement without having to extract fluids for later analysis.

The significance of ElectroNeedle™ technology has been recognized by both the commercial sector and by the medical community. Two new biotechnology companies — New Mexico Biotech, Inc., and Life BioScience, Inc., —formed in Albuquerque, New Mexico, explicitly for ElectroNeedle™ commercialization. One company already licensed the IP portfolio that became available during 2006 and negotiations are underway with the second. Sandia will provide on-going research into the technology and technical guidance to the licensing organizations. The licensee(s) are expected to develop the commercial product, to pursue FDA approval for the product, and to provide funding to Sandia for continued R&D.

Although human healthcare is the principal application for this technology, the ElectroNeedle™ Biomedical Sensor Array also has equivalent veterinary applications. Rapid and low-cost disease detection in agricultural livestock will produce enormous economic impact worldwide. For example, a foot-and-mouth outbreak in 2001 cost Great Britain an estimated $15 billion.

This technology won an R&D 100 Award in 2007. The awards are given by *R&D Magazine* to the 100 most significant technical products that became available in that year.

Electro Optic Voltage Sensor System

In June 2007, residents of Manhattan and the Bronx experienced a brief power outage due to a storm system blowing through. Several traffic lights were knocked out and subway services were cut by the outage. The outage affected approximately 385,000 people. However, even after the power was restored, the effects of the blackout continued to be felt.

According to OptiSense Network, a privately held company located in Bridgeport, Texas, a technology called Electro Optic Voltage Sensor System can measure an electric field without actually touching it, allowing utilities to detect and locate a power failure before customers call to report it. Therefore, in the case of the New York event, a system like the one created by OptiSense would have enabled utilities to know where the power outage occurred before anybody actually called.

Licensed to OptiSense in 2001, the Idaho National Laboratory (INL) developed sensors are capable of distribution measurements of voltages from 15,000 to 69,000 and offer numerous benefits including increased safety, capacity, security, reliability, productivity, lowered cost and environmentally friendly characteristics. The company's technology will enable utility companies to monitor feeder circuits more cost effectively, enhance system operations, optimize power flows, and provide greater grid security and reliability. The sensors are smaller and lighter in weight compared to existing equipment and the high voltage sensors will also allow placement in locations where the existing measurement would be impossible to install.

In 2007, OptiSense received feedback from two major utilities that the sensors reduce capital expenditure costs and real-time monitoring of the distribution grid translates into 2% annual capital expenditure savings. OptiSense has also sold units to Alabama Power, a field test trial customer of the product. As tests continue to be done on the technology, sales projections suggest that OptiSense has the potential to contribute more than $80 million per year to the Texas economy. OptiSense hopes to target a bigger audience; utilities that operate within voltages of 15 to 100 kilovolts, which works out to be about 99% of utility companies.

Among other successes, OptiSense recently received $1.5 million from the Texas Emerging Technology Fund (ETF), which will allow OptiSense to further develop the sensor system. Along with five technology companies and schools, Optisense, shared more than $13 million in state grants. The ETF, created by the Texas Legislature, is used to expedite the development and commercialization of specific technologies.

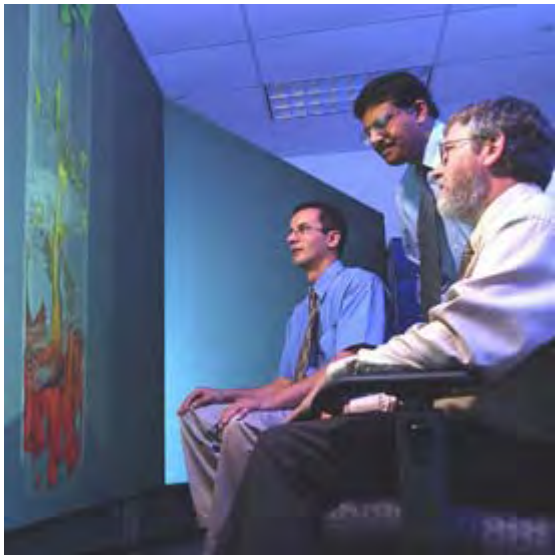
The Electro Optic Voltage Sensor System, licensed to OptiSense Network, can measure an electric field without actually touching it.

Enhancing Advanced Coal Technologies
with Multiphase Flow with Interphase eXchanges (MFIX)

Developed at the National Energy Technology Laboratory (NETL) with support from Aeolus Research, Inc., Parsons, Inc., and Oak Ridge National Laboratory (ORNL), MFIX (Multiphase Flow with Interphase eXchanges) is a software solution for reducing the cost of developing and commercializing the technologies that will allow the clean and efficient use of coal. The developers are Sofiane Benyahia (NETL/DOE), Aytekin Gel (NETL/Aeolus Research, Inc.), Chris Guenther (NETL/DOE), Philip Nicoletti (NETL/Parsons Inc.), Thomas J. O'Brien (NETL/DOE), Sreekanth Pannala (ORNL), Mike Prinkey (NETL/Aeolus Research, Inc.), William Rogers (NETL/DOE), and Madhava Syamlal (NETL/DOE).

The much-needed software solves physics-based equations to simulate various processes that occur in critical equipment, such as coal gasifiers. The cheaper simulations encourage engineers to dream-up the pioneering designs needed for generating clean, coal-based energy. Coal is America's most abundant energy resource and generates more than half of our electric power. The drawback is that coal is also a high producer of carbon emissions. Developing the technologies that will enable us to use coal cleanly, efficiently, and with less carbon emissions is essential; but also complex.

Researchers develop designs that use solid fuels and repeatedly build and test these designs at several different scales. But the high cost of these demonstrations limits the opportunities engineers have to test innovative designs of coal processing reactions, and the radical ideas needed to develop the novel designs for near-zero emissions future power plants cannot be explored. MFIX brings these ideas back to the table by replacing build-and-test steps with accurate and less-costly simulations. MFIX Version 2006-4 was released in December of 2006 and is available for download from http://www.mfix.org/. This technology won a 2007 R&D 100 award.



The Multiphase Flow Research Group in the Office of Research and Development at NETL develops capabilities to accurately model fossil power generation technology employing dense, reacting multiphase flow. From left to right, Sofiane Benyahia, engineer; Madhava Syamlal, engineer; and Phillip Nicoletti, computer scientist, look at details of a visualization of a fluidized bed gasifier.

Foam-Based Decontamination

Recently the world media reported stories about an intercept of weapons-grade uranium in the former Soviet republic of Georgia, and, in Kazakhstan, a man was sentenced for attempting to sell radioactive isotopes that could be used to make a “dirty bomb”. These and other events demonstrate the potential risk of small-scale nuclear terrorist acts. A “dirty bomb” and other kinds of radioactive dispersal devices (RDDs) are primarily economic and psychological weapons. American strategists fear that buildings that are precious national icons could be targeted for terrorist attack. The U.S. Defense Advanced Research Projects Agency (DARPA) and the Department of Homeland Security have actively sought the development of novel decontamination methods for RDDs. In response, Idaho National Laboratory (INL) developed a new technology to safely and effectively remove radioactive contamination from various types of urban surfaces.

Non-destructive removal of radioactive materials challenged the research group’s ingenuity because these isotopes have a high affinity to the composition of most building materials. Removing contaminants without injuring the surface was the primary objective of this project. In addition to the need to make the affected areas safe as quickly as possible, preserving the appearance and structure of buildings and monuments that Americans revere was very important.

The team’s experience with decontaminating radionuclides from concrete and other surfaces was very relevant to DARPA’s focus. DARPA asked the INL team to develop a foam-based decontamination approach that “shifted the affinity” of the radionuclide from the building surface to the decontamination solution. They defined success as capturing and removing radioactive particles without further contamination of the soil or ground water, in a manner that was safe for first responder use, and that would not remove or deface building surfaces (as typical scabbling or physical removal processes do).

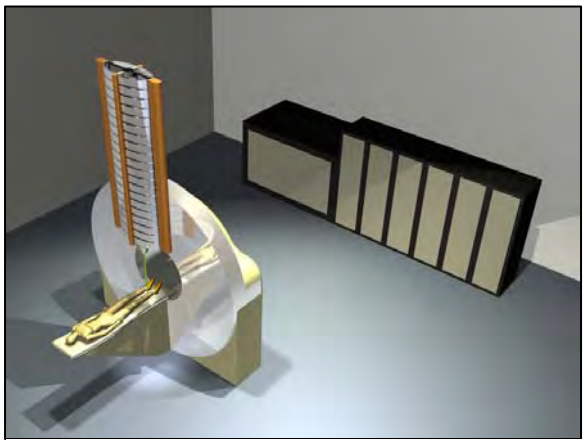
Says researcher Julia Tripp, “[The technology] actually does better than anything else I’ve ever seen at getting certain radionuclides out of concrete.” On marble, up to 88% of the contamination was removed by the foam and within six weeks after paste application, approximately 97% of the radioactive contaminant was removed. On concrete, the foam removed about 30% of the radioactive contaminant and within six weeks after paste application, approximately 89% removal was obtained.

In September 2007, the decontamination technology was transferred to Environmental Alternatives, Inc., located in Keene, NH, by way of an exclusive license.

Contrasted with decontamination carried out by destroying and hauling away buildings, recovery from the effects of an RDD is enormously enhanced

Making Proton Therapy More Accessible to Cancer Patients

More than half of the roughly one million people diagnosed with cancer each year will be treated using radiotherapy. Conventional radiotherapy kills cancer cells using X-rays that deliver high energies to all the tissues they travel through, from the point they enter the body until they leave it. A more advanced form of radiation therapy uses proton beams that deposit almost all of their energy on their target, enabling doctors to hit tumors with more effective radiation doses than is possible with conventional radiation.



Artist Rendition of a Possible Proton Therapy System

Despite its usefulness, proton therapy remains available at only 25 cancer centers worldwide due to the substantial size and cost of implementing the technology. The Dielectric Wall Accelerator (DWA)—the technology behind a proton therapy system that is expected to fit in standard radiation oncology clinics and cost significantly less than conventional proton therapy systems—intends to overcome these hurdles and make proton therapy more widely available. An offshoot of defense-related research at Lawrence Livermore National Laboratory (LLNL), the DWA accelerates protons to the required energies for cancer treatment without using bending magnets or other techniques that take up space and generate unwanted radiation.

In 2005, the DWA research team, jointly funded by LLNL and the University of California (UC) Davis Health System, achieved component feasibility for a compact proton accelerator that uses the DWA. Efforts to commercialize the technology failed, however, because the project lacked a working prototype. In early 2006, both parties took the unusual step of investing $1.5 million each towards developing a prototype. Because of the DWA, LLNL created a strategic technology maturation fund for technologies that provide a demonstrable spin back to a Laboratory program, or can make significant contributions to an important national problem, in this case, cancer therapy.

The team then looked for a commercial partner that could integrate the DWA into a proton therapy system. TomoTherapy, Inc. was one of the companies that expressed interest. It officially submitted a commercialization plan in June 2006, and by February 2007 a license and a CRADA were executed.

The successful transfer of the DWA technology is serving as a model for future endeavors. LLNL and UC Davis are now collaborating on over a dozen projects that promise breakthroughs in the detection, treatment, and prevention of cancer. The DWA technology and team won a 2007 Federal Laboratory Consortium (FLC) Far West Region Award for Outstanding Technology Development.

Managing Heat and Water in Fuel Cells

Pacific Northwest National Laboratory (PNNL) has developed a remarkable new device which overcomes the force of gravity to perform several challenging processes with gases and liquids within microchannels. The Microchannel Gas-Liquid Processing Device (MGLPD) offers a unique solution for managing heat and balancing water consumption in fuel cell systems and fuel processors. Its passive operation, compact size, and orientation make this product a powerful option for several fuel cell applications such as vehicle, auxiliary power units and electronic systems. Fuel cell technologies like the MGLPD have the potential to address many of our fuel, energy, security and environmental issues, including national dependence on petroleum imports, poor air quality, and greenhouse gas emissions.

Fuel cells are an important part of meeting the country's future power needs. The challenge is to make fuel cell systems practical to use by reducing their size and weight. The MGLPD achieves that by providing a compact solution for recovering water in these systems and reducing or eliminating the need to store water for their operation. Inside the MGLPD, thermal and chemical processing occurs in tiny microchannels which results in extremely rapid heat and mass transfer rates that allow for reductions in size and weight.

The MGLPD has a suite of products that perform the necessary steps for managing heat and recovering water to balance consumption in fuel cell systems and fuel processors. A phase separator segregates gases and liquids in mixtures. The microchannel condenser recovers the water vapor from the gas by cooling the stream with ambient air and then collecting the condensate that forms. Finally, a distillation device removes small molecules of sulfur, which poison fuel cells.

This new PNNL fuel cell technology is a significant breakthrough for the industry. The innovative device advances the usability of fuel cells with its ability to recover and recycle liquid from within the fuel cell system. This adaptable and flexible new technology operates independent of orientation and gravity to make it applicable to a wide range of portable, mobile and space applications. In fact, NASA is pursuing the technology for processes to recover water from lunar regolith that can then be separated to produce hydrogen and oxygen.

The Microchannel Gas-Liquid Processing Device revolutionizes fuel cell technology by heating, cooling, removing, and recovering water and distilling poisonous sulfur from diesel fuel for conversion to hydrogen.

Midwest Forensics Resource Center

The United States Department of Justice National Institute of Justice (NIJ) and the Department of Energy Ames Laboratory collaborated in a successful multi-year effort to transfer forensic science technologies, products and services to government crime labs. The collaboration is implemented by Ames Laboratory's Midwest Forensics Resource Center (MFRC). Its five crime-laboratory-specified mission is to address innovations in crime laboratory management and infrastructure; to administer a program of peer-reviewed forensic science research; to provide specialized casework assistance; to organize forensic training and crime laboratory professional development activities; and to coordinate with university forensic science education programs. The MFRC serves publicly funded crime laboratories in 12 Midwestern and Central states, though other states as well as federal forensic laboratories can participate in the MFRC's mission-related projects as well.

While not an original mission of the MFRC, Technical Innovations in Management Infrastructure (TIMI) was requested by crime laboratory directors. The MFRC verified the demand and engaged its NIJ program manager in the task of mission-expansion. TIMI studies have since investigated laboratory information management systems, radio frequency identification tagging, crime laboratory process mapping techniques, and internet-based systems for the real time peer review of casework.

The MFRC issues periodic calls for forensic science research, all of which must contain partnerships among researchers and forensic scientists. Twenty-eight R&D projects have been funded over the last 5 years; each project established working partnerships among university and federal laboratory researchers and forensic examiners.

The MFRC assists crime laboratories in analyzing unusual or difficult casework; averaging 6-8 requests per year. Specifically, the MFRC searches communities, colleges and universities, state and federal laboratories, and the private sector seeking the expertise, equipment or facilities required. The MFRC provides financial support for up to 40 hours of analysis time when a new organization or a new resource is requested to handle specialized casework.

The MFRC's training program has provided 27 classes for forensic examiners since 2003. In partnership with the Midwest Association of Forensic Scientists (MAFS), it organized and delivered the nation's first true forensic symposia—one in Trace Evidence Analysis and another in Forensic Drug Chemistry. As a result, the MFRC has developed a symposium series, and plans to extend it to other topics. The MFRC also completed and distributed 10 forensic science training DVD's addressing scientific/analytical, evidence analysis, and laboratory-wide topics that are used as in-house training in many Midwestern crime laboratories.

Modified Cast Stainless Steel, CF8C-Plus

Advanced heavy truck diesel engines require higher fuel efficiency and reduced emissions, without sacrificing durability and reliability. Diesel exhaust components (manifolds, turbocharger housings) must now endure duty cycles that push maximum temperature beyond 750oC, and yet still must retain similar or longer life and reliability.

To meet the performance demands of future advanced on-highway diesel engines, Caterpillar Inc. and Oak Ridge National Laboratory (ORNL) engaged in a collaborative research and development agreement (CRADA) project several years ago to develop cost-effective materials upgrades for the SiMo cast iron currently used in diesel exhaust components. Commercial cast stainless steels (like CF8C) had some of the desired properties but lacked others. ORNL and Caterpillar developed a new modified cast stainless steel, CF8C-Plus, that had very good high-temperature properties (resistance to creep-rupture, fatigue, thermal-fatigue, aging and oxidation), and very good castability, but still had about the same cost as the standard CF8C steel grade.

Caterpillar Regeneration System (CRS) Housing

CF8C-Plus is a new grade of cast austenitic stainless steel which has mainly additions of Mn and N, relative to the standard CF8C steel grade. CF8C-Plus Cu/W is another modification, with Cu and W added to provide additional strength at 750-850oC. The engineered microstructure has a fully austenite parent phase matrix (ordinary CF8C has about 20-25% deleterious delta ferrite) in the as-cast condition. During high-temperature exposure, nano-dispersions of NbC form to strengthen the matrix, and there is no sigma phase or other embrittling intermetallic phases formation.

This special microstructure gives CF8C-Plus about twice the creep strength of standard CF8C steel. The stable, strong austenite also gives CF8C-Plus very good fatigue, thermal fatigue and resistance to aging-induced embrittlement. The high temperature creep strength of CF8C-Plus and CF8C-Plus Cu/W approaches that of the Ni-based superalloy 617,which is about five to seven times more expensive. CF8C-Plus has much better castability than CF8C steel, so that thin or thick section parts can be made without defects. CF8C-Plus and CF8C-Plus Cu/W both have good weldability, and require no additional heat-treatments prior to service.

Near-Frictionless Carbon Coatings

Argonne National Laboratory (ANL) developed a coating system to produce and deposit near-frictionless carbon (NFC) coatings that are many times slicker than Teflon. Like the bench-scale NFC coating system developed by Argonne, the new industrial-scale system developed jointly with CemeCon USA is revolutionary. The new CemeCon machine offers a unique capability to produce coatings that combine hardness, wear-resistance, super-low friction, and low-temperature coating capability.

Photograph of industrial-scale NFC coating system

CemeCon-USA, a subsidiary of CemeCon AG in Germany, is a global technology leader in hard- and super hard coatings. The company, based in Horseheads, New York, offers coatings for machining tools and automotive components and produces physical- and chemical-vapor deposition systems, often customizing the systems for specific customers or applications (http://www.cemecon.com/). CemeCon already had a brand of its own diamond-like carbon coatings, but wanted a much slicker coating that could be produced by using a lower-temperature process. Such a process would offer advantage in terms of substrate, allowing the coating to be placed on a wider variety of materials, not just those that could withstand the high temperatures required by CemeCon's original processes — NFC coating can be produced at much lower temperatures (i.e., room temperature to 200^{o}C) using less expensive precursors and in less complex systems.

Like the coating system itself, the process used to transfer the NFC technology was creative, yet focused. The Argonne team worked hard to ensure that the transfer process would give the technology the best possible odds for success. As a federal laboratory, Argonne used its many resources — technical expertise, state-of-the art equipment, and contacts with numerous potential funding agencies — to transfer the technology to a company that will help ensure that it enjoys widespread use. From the first step — generating interest in the technology — through developing a licensing agreement that considered all the risks involved in scaling up the technology, the Argonne team demonstrated persistence, flexibility, creativity, and a remarkable commitment to working with its industrial partner to overcome some the obstacles to commercialization.

New Advancement in the Ferret Technology

Q Technology, originally called Ferret, was invented at the Y-12 National Security Complex in Oak Ridge, Tennessee to help Y-12's classification personnel analyze and classify sensitive documents related to nuclear weapons. Licensed to AreteQ, Inc., in Athens, Tennessee, the software is being adapted to various environments.

Q uses a knowledge base network of concepts and special patterns to interpret text; it has proven remarkably accurate (over 90% with a reasonably mature knowledge base), executing at speeds in excess of 15,000 words per second. A finalist at the World's Best Technologies Conference, in March 2005, Q is used in Y-12's Web-based Classification Resource System and Sandia National Laboratories uses Q for weapons design information.

There is tremendous potential for Q technology in both government and private-sector applications. Unlike popular search engines, which can return thousands of hits to a simple query, Q provides users with exact information to answer questions.

Highlighted words were identified as suspect by AreteQ's new Q-based redaction tool.

AreteQ is adapting and enhancing the computer code for commercial applications. The multi-billion dollar durable medical equipment (DME) industry is largely regulated by Medicare. Unfortunately, the complexity of Medicare regulations leads to many denials of claims because people can't find the right information or answer to their question.

In 2005, AreteQ joined with the DME supplier, Jaysec, of Athens, Tennessee, to incorporate Q into a Web-based application—AskJaysec—to answer questions concerning home medical equipment qualifications and billing. "It's like a help desk ensuring correct qualifications and Medicare billing information for the end-user," says Al Klein, Y-12's liaison to AreteQ. Y-12 and AreteQ's collaboration has brought the technology full circle.

"It's like a help desk ensuring correct qualifications and Medicare billing information for the end-user," says Al Klein, Y-12's liaison to AreteQ. Y-12 and AreteQ's collaboration has brought the technology full circle.

Additional Applications

A medical version electronically examines physicians' notes to determine the evaluation and management codes for billing and insurance purposes while, in legal applications, Q "is protecting proprietary-business or sensitive merger-and-acquisition information." The Virtual Help Desk application replaces answers to frequently asked questions and key-word searches. The potential market for this application of Q is in the billions of dollars.

Redaction of documents is another area of potential growth. The Freedom of Information Act (FOIA) requires agencies to provide requested information not exempted from release. Documents containing such information may be released after they have been redacted, or "sanitized." Using an expanded Q to automate this process will save millions of dollars.

New Radiation Detectors

Development and commercialization of a new generation of multiplicity shift registers— devices used to better detect plutonium and other radioactive materials—is now underway. Under a Cooperative Research and Development Agreement (CRADA), Los Alamos National Laboratory (LANL) and Canberra Albuquerque Inc. will develop the new benchtop or handheld devices, which have the potential for use in homeland security applications domestically and abroad.

Artist's rendering of a prototype of the new generation of multiplicity shift registers currently under development at Los Alamos.

These instruments, first developed by the Lab more than 15 years ago, count and analyze pulse streams generated by neutron detectors to quantify radioactive materials. They are currently used by the International Atomic Energy Agency (IAEA) to ensure that radioactive materials are not lost, stolen, or used for military purposes.

According to LANL researcher and principal investigator Matt Newell, the new multiplicity shift registers are needed because existing devices are nearly 10 years old and becoming incompatible with other detection technology used by the IAEA.

“We were contacted by people who use the current technology, asking us to do some new development,” Newell said. “Many of the parts used to make the current shift registers are obsolete or becoming obsolete.”

Under the recently-signed agreement, Canberra Albuquerque will fund the development of a new multiplicity shift register, which can continuously store neutron measurements automatically without an operator present, for use in remote or unattended operations. In addition, the company will validate the use of a handheld, battery-operated multiplicity shift register already developed by Newell and his team. Both devices will be faster, easier to use, compatible with new measurement instrumentation, and designed in accordance with IAEA guidelines.

The Laboratory and Canberra expect testing and commercialization to take approximately two years, after which Canberra Albuquerque intends to manufacture the instruments at its Albuquerque facilities.

“Our collaboration with Los Alamos National Laboratory is vital to Canberra's work extending the boundaries of neutron-counting technology,” said Dr. Markku Koskelo, Vice President of Special Projects. “Together we have built a roadmap for the next generation of shift registers.”

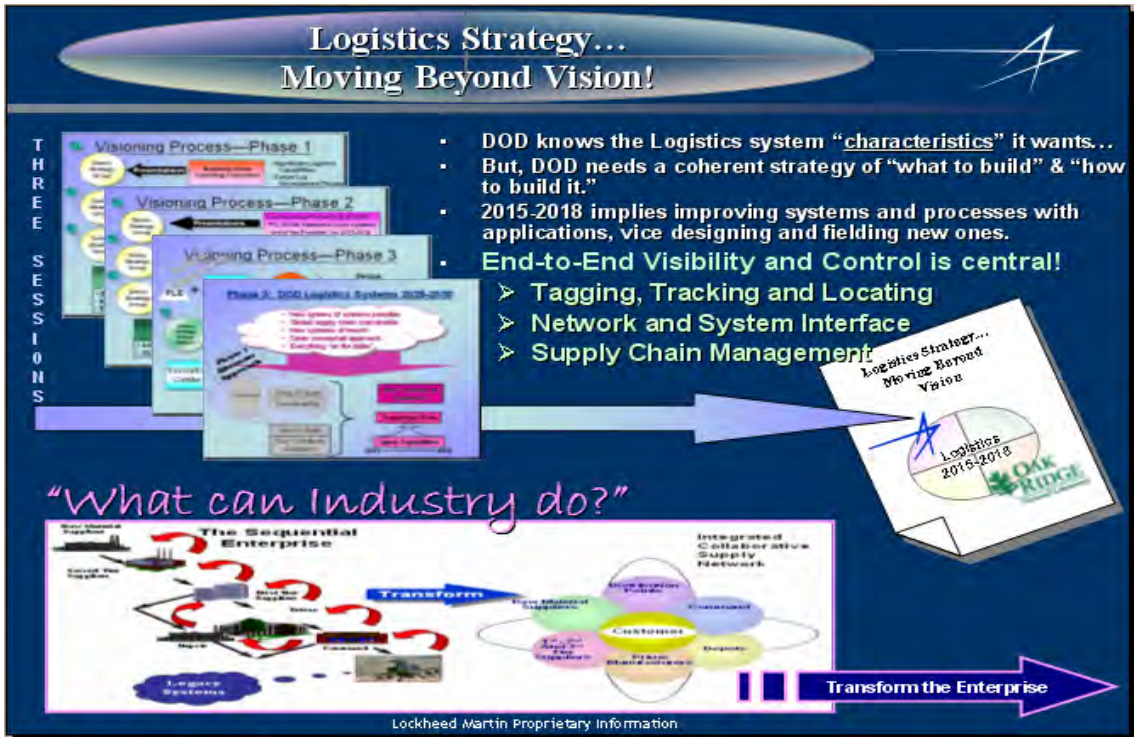
Next Generation Logistics Planning and Technology

In September 2007 Oak Ridge National Laboratory (ORNL), completed a nearly one-year Work for Others (WFO) effort with Lockheed Martin Corporation (LMC) to develop a perspective of logistics in the Department of Defense (DOD) for the years 2015-2018. A series of three conferences and other meetings included participants from ORNL's Logistics Visioning team—LTG(R) George Fisher and MG(R) Dennis Jackson— along with LMC, the University of Tennessee, the DOD, and multiple representatives from the private sector.

What began as a visioning effort by a team of logistics planners at ORNL resulted in a template for next generation logistics planning and technology. This collaborative effort is continuing through development of future potential for tagging, tracking, and locating systems and intelligent agents, two of the technology areas identified during the initial meetings. Dr. Mark Buckner (EESD), Dr. Tom Potok (CCSD), and Dr. Cathy Jiao (CCSD), are developing Cognitive Radio and Intelligent Agent architectures for LMC's subordinate, Savi Corporation.

The architecture will present a methodology for application and integration of software defined/cognitive agents and hardware on future radio frequency identification technology. This project will assist LMC in pursuing a leap-ahead approach to tagging, tracking and locating by developing devices and systems that are much more collaborative and decentralized than current technologies.

The expectation is that LMC will ask ORNL to demonstrate this architecture in a relevant environment in 2008. If successful, this technology could greatly improve supply chain integration and management capabilities in both the private and public sectors.

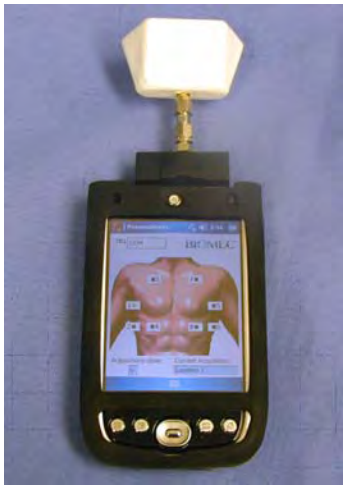


Noninvasive Pneumothorax Detector

Pneumothorax is a medical condition caused by air trapped in the space between the wall of the chest cavity and the lung. It is usually attributed to a trauma to the chest. If not properly diagnosed and quickly treated, pneumothorax can cause death in minutes as each breath taken further collapses the lungs. The method currently used to definitively diagnose a pneumothorax involves chest x-rays or computed tomography (CT) scans. However, in some cases there may be no time to acquire and analyze x-rays or CT scans, or the patient may be in a remote location where this method is not an option. Instead, medical response personnel in the field must infer the possibility of a pneumothorax by the inaccurate and nonspecific method of looking for respiratory distress, listening for unusual sounds in the lungs, and feeling for broken ribs.

In urgent situations, when quick and accurate diagnosis is necessary to save a patient's life, the ideal solution is the portable, light-weight, battery-operated, Noninvasive Pneumothorax Detector. Researchers at Lawrence Livermore National Laboratory (LLNL) created an instrument that leverages the ultra-wideband (UWB) technology. This handheld device can accurately diagnose pneumothorax in real time. It is a life-saving diagnostic tool that can be used in a hospital setting and in the field, where early, quick, and accurate diagnosis and continuous monitoring of pneumothorax is needed most.

In 2007, LLNL signed a second CRADA with ElectroSonics Medical, Inc. (previously called BIOMEC, Inc.), a small business located in Cleveland, Ohio to further develop a Noninvasive Pneumothorax Detector. This CRADA is a result of receiving an additional National Institutes of Health SBIR Program Phase II grant to further investigate and refine the detector's capabilities in human research subjects and to develop the hardware in preparation for commercialization. Preliminary data indicated an overall accuracy of 91% reliability. The Noninvasive Pneumothorax Detector technology and team won a 2007 R&D 100 Award.



The Noninvasive Pneumothorax Detector final device concept connected to a standard PDA with a graphical interface to guide diagnosis.

Novint Falcon and Novint/Sandia 3D-Touch Software

The award-winning Novint Falcon is the first controller that makes high-fidelity interactive three-dimensional touch possible and practical for consumer computing applications. Although it is applicable to—and could fundamentally change and improve—dozens of billion dollar markets, it is being introduced initially as a PC game controller. The Novint Falcon, essentially, is a small robot, yet its industrial design is something that consumers will enjoy having on their desktop.

The Falcon lets users feel weight, shape, texture, dimension, dynamics, and force effects when playing enabled games. Using the Falcon, players experience a full range of realistic touch sensations that allow them to control a game more naturally and intuitively. Instead of using mouse clicks and meters, players feel the weight of a basketball as they shoot it toward a hoop; the momentum and impact as they swing a virtual golf club and strike a ball; the recoil of a weapon; and the characteristics of virtual objects and environments. The Novint Falcon is also the only consumer game controller that provides players with both 3D input and high-fidelity force feedback.

The Novint Falcon and its 3D-Touch Software let consumers, for the first time, use an accurate sense of touch in computing. Photo by Novint, Inc.

Novint's software technology is largely based on technology originally developed at Sandia National Laboratories, which was exclusively licensed by Novint for commercialization. Novint also partnered with Lunar Design (http://www.lunar.com/), an award-winning industrial design firm, and Force Dimension (http://www.forcedimension.com/), a leading Swiss developer of high-end haptic devices, in the development of the Falcon.

This technology won an R&D 100 Award in 2007. The awards are given by *R&D Magazine* to the 100 most significant technical products that became available in that year.

Powertrain System Analysis Toolkit

Developing advanced vehicle technologies such as HEVs requires accurate, flexible simulation tools. Argonne National Laboratory's (ANL's) Powertrain System Analysis Toolkit (PSAT) is a state-of-the-art flexible and reusable simulation package designed to facilitate advanced vehicle (e.g., hybrid, plug-in hybrid, fuel cell) development. Developers Aymeric Rousseau, Phillip Sharer, and Sylvain Pagerit received the 2007 FLC Award for Excellence in Technology Transfer. PSAT was funded by the U.S. Department of Energy's FreedomCAR and Vehicle Technologies Program.

PSAT was designed to serve as a single tool that can meet the requirements of automotive engineering throughout the development process from modeling to control. PSAT allows users to accurately model advanced vehicle components, their control strategies, and components interactions in a systems context, enabling users to conduct detailed laboratory benchmark testing of advanced components as they are being developed. PSAT provides accurate performance and fuel economy simulations, permitting automotive and truck manufacturers and their suppliers to quickly select the advanced technologies that will best meet their needs, thus helping them bring their advanced vehicles to market as quickly and cost effectively as possible. Thus far, PSAT has been transferred, through licensing agreements, to more than 200 users worldwide. Licensed PSAT users include major automakers and automotive suppliers, energy companies, research institutions, and universities.

Shown here, members of the PSAT development and support team (from left) Aymeric Rousseau, Jason Kwon, Phillip Sharer, and Thierry Ciszewski, confer.

T7 Gene Expression System

Dr. F. William Studier

Dr. F. William Studier, a biophysicist at the U.S. Department of Energy's Brookhaven National Laboratory (BNL), developed a new process that simplifies the production of proteins in the widely used T7 gene expression system. The T7 expression system, developed and patented at Brookhaven Lab in the 1980s and 1990s, is used worldwide by academia and industry to produce specific proteins within bacterial cells.

Studier's new method simplifies the production of many proteins in parallel. Proteins do most of the work in biological systems. They digest food for energy; build biological structures, such as muscles and neurons; and regulate biological functioning, for example, by hormones. The Human Genome Project and other genome sequencing projects are revealing the full complement of human proteins and the proteins of many other organisms. Expression systems such as the T7 system allow biologists and medical scientists to obtain useful amounts of individual proteins for analyzing their structures and functions.

Commercially available through EMD Biosciences, Novagen brand, as the Overnight Express Autoinduction System, the new method relies on mechanisms by which bacteria sense the presence of nutrients in their surroundings and select which ones to use. An appropriate mixture of nutrients allows the bacteria to grow vigorously and then, at the appropriate stage of growth, switch automatically to producing the target protein without any intervention by the experimenter. The new method will be useful for biomedical research or for industrial production of proteins to use as enzymes, diagnostics, vaccines, therapeutics and targets for developing pharmaceuticals.

Studier started his research on T7, a common bacteria-eating virus - when he first joined BNL in 1964. "The T7 expression system came out of basic research," Studier said, "and the autoinduction system is also an application of basic knowledge. As so often happens, basic research led to useful applications in unexpected ways."

Studier's research is funded by the U.S. Department of Energy's Office of Biological and Environmental Research within the Office of Science, and by the Protein Structure Initiative of the National Institute of General Medical Sciences of the National Institutes of Health as part of the New York Structural Genomics Research Consortium.

TECHNOLOGY TRANSFER

SUCCESSES

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EnerDel/Argonne High-Power Battery for Hybrid Electric Vehicles

Argonne National Laboratory and EnerDel have teamed up to bring in the next generation of lithium-ion battery for hybrid electric vehicles (HEVs). The EnerDel/Argonne lithium-ion battery is a highly reliable and extremely safe device that is lighter in weight, more compact, more powerful and longer lasting than the nickel-metal hydride (Ni-MH) batteries in today's HEVs.

The EnerDel/Argonne battery does not use graphite as the anode material, which is a safety concern in other Li-ion battery brands. Instead, Argonne developed an innovative, more stable new form of nano-phase lithium titanate (LTO) to replace the graphite. It also developed a new way of making nano-phased LTO that will allow for easier industrial processing, as well as provide a high packing density that can increase the battery's energy density and provide the power needed for vehicle acceleration and regenerative charging of HEVs.

The battery is expected to meet the U.S. Advanced Battery Consortium's $500 manufacturing price criterion for a 25-kilowatt battery, which is almost a sixth of the cost to make comparable Ni-MH batteries intended for use in HEVs. It is also less expensive to make than comparable Li-ion batteries. That cost reduction is expected to help make HEVs more competitive in the marketplace and enable consumers to receive an immediate payback in gas-cost savings rather than having to wait seven years for the savings to surpass the premium placed on HEVs.

The battery's principal developers included researchers from both Argonne National Laboratory and EnerDel. EnerDel is owned by Ener1, Inc. and Delphi Corp. With its production center in Indianapolis, IN, EnerDel is heavily involved in the battery development of both cells and systems.

e EnerDel/Argonne Lithium-Ion Battery

INL technology may prove to be the most powerful forensic tool since DNA

By Keith Arterburn

Real world forensic investigation is getting closer to the one-hour crime-solving television world with a new invention called Antibody Profiling Identification or AbP ID. AbP ID identifies individuals based on immune system antibodies which by the age two are as unique as DNA or fingerprints. These antibodies are different even between identical twins.

Researchers at the **Idaho National Laboratory** developed the method to turn individual antibody profiles into a unique pattern that can be used to identify an individual from very small samples of blood, sweat, tears and other bodily fluids.

Working closely with partner and licensee, Identity Sciences, LLC, located in Alpharetta, GA, they have developed AbP ID into a commercially available testing system with pattern identification software that provides sample analysis results and comparisons in 2 to 5 hours (compared with days or weeks for DNA). AbP ID provides a low-cost, easy-to-use, accurate, and rapid method for matching individuals with forensic evidence. AbP ID uses a proprietary immunoblotting method to detect and visualize individual autoantibody patterns. Using the AbP ID test, a microsample of only 1/50th of a drop of blood placed on a specially prepared paper strip impregnated with 10,000 proteins will reveal a unique visual profile of 20-30 dark bands.

This animation shows how specific auto antibodies bind to companion proteins on each AbP ID test-strip. Once developed, a unique pattern emerges; linking the sample to the individual it came from. Because AbP ID does not require cellular material, it is a very versatile forensic tool that works with fluids such as tears and perspiration. AbP ID also incorporates an R&D 100 award winning digital image comparison technology, INL's Change Detection System. The Image ID system can scan test strips, archive patterns into a database similar to fingerprint or DNA databases and compare samples to any or all samples in the system.

Beyond its valuable forensic application, AbP ID can be used as a quick method for identifying individuals in a hospital setting, tracking test results or samples, organ matching and confirmation, and has the potential for use in identifying specific infections.

AbP ID also could be used in security to confirm identities, as well as in agriculture for tracking animal products from the farm to the store shelf. AbP ID is a major breakthrough in forensic evidence identification. In FY-08 AbP ID was recognized with several awards, including an R&D 100 Award, two FLC Awards and an Idaho Innovation Award.

Motion to Energy Power Generation System

By Keith Arterburn

Capturing energy from motion has long been a dream of inventors, but now it is a reality.

Idaho National Laboratory inventors working with research partner and licensee M2E Power, Inc, based out of Boise, ID, have succeeded in converting the power of motion into electrical generation and battery charging.

The technology they developed, M2E – motion to energy power generation systems are not only commercially viable, they have created buzz among mobile device technophiles, green energy advocates and military developers. This sophisticated technology uses an innovative, optimized micro-generator with power management circuitry that kinetically charges mobile batteries from natural motion, such as walking. This breakthrough technology eliminates the need for recharging - taking mobile devices off the electrical grid. This changes the very nature of mobile power. No longer will people need to plug in to get the power needed for smart phones, digital camera, gaming devices or mobile audio player. The M2E solution uses lightweight, self-charging power units that convert kinetic energy from walking or vehicular motion into electricity. It uses an efficient micro-generator small enough to fit into D, AA, AAA, and cell phone batteries. It can even be scaled to microchip-embedded power systems.

The breakthrough behind M2E power generation is the invention of a new magnetic architecture that combines creative use of materials and coil design to harvest energy, even from lower frequency movement. M2E also uses an innovative compressed and unbalanced magnetic field, now a patented part of the invention. The design improvements permitted macro- and micro-motions to cumulatively generate charges with up to a 700%+ improvement over state-of-the-art kinetic generators. A test at MIT found that one self-charging battery on the market produced 2mw at 3 hz in 5 minutes, while M2E produced 9.75 mw at 2 hz in the same time period. Battery life can be measured in years, not hours or days.

M2E first is being developed to ease the military's battlefield burden, which has proliferated to nearly 500 battery-operated devices. M2E will also revolutionize the mobile device marketplace with many commercial applications.

However, soon M2E developers will begin pursuing scalable applications from Nano to Macro. That means development at the Nano level for medical and electronic applications, as well as Macro for large-scale hydro, wind, tidal, ocean wave and transportation power systems.

M2E is beginning with batteries, but its potential is truly unlimited.

M2E Power Generation Technology is being developed in a form factor that matches Future Force Warrior Li-145 rechargeable battery. M2E Photo

Stun Baton

When AEgis Technologies, a commercial company realized their original product concept for a stun baton was too bulky to easily wield, they asked the **Kansas City Plant** to access its extensive miniaturization capabilities developed through their years of nuclear weapon component manufacturing support. The product idea presented to the Kansas City Plant was a novel Human Electro-Muscular Incapacitation (HEMI) device in the form of a blunt force baton.

Through a Work for Others Agreement, the Kansas City Plant began the concept formulation step of its phase-gated process. They determined that, in addition to being too bulky and difficult to wield, the baton had to be able to handle a blunt force situation typical of a standard issue police baton. An additional challenge was created by the fact that the original design featured highly medically-studied waveforms which could not be compromised in the manufacturing process. The company also challenged the Kansas City Plant to develop as many product features that could be included in the single device as possible.

Through a series of feasibility studies, the Kansas City Plant was able to add significant additional features to the stun baton. Most notable was the addition of a laser dazzler, and options for recording capabilities and thumbprint verification.

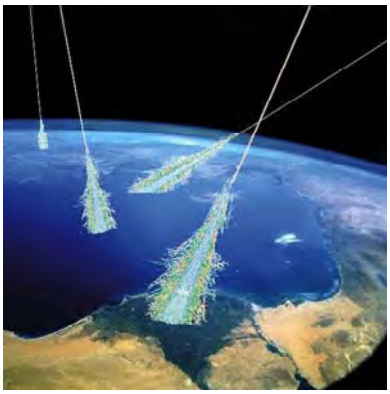
The Kansas City Plant product realization process to complete a final field-ready stun baton, included:

- Completion of the product miniaturization with no adverse effects to the original electrical and medical characteristics
- Completion of a thorough FEA analysis, resulting in further development to make the product more rugged
- Completion of an additional miniaturization study on all product components to fulfill customer packaging needs
- A full finite element analysis (FEA) to verify impact characteristics of the product
- Completion of electrical simulations to verify original operational characteristics and specifications were not effected by the new design

The Stun Baton has now been fully commercialized and is being marketed to Homeland Security and First Responder organizations throughout the country.

Exclusive Commercial License for Muon Tomography

LOS ALAMOS, N.M., October 7, 2008 — Los Alamos National Laboratory has granted Decision Sciences Corporation (DSC) an exclusive worldwide license to commercialize muon tomography, a LANL-developed technology. Muon tomography uses naturally occurring cosmic-ray muons, a type of subatomic particle, to detect and identify concealed nuclear threat materials based on their atomic number and density. Unlike other imaging and detection techniques, such as X-rays, muon tomography cannot be fooled by threat materials that have been shielded because the dense shielding material is itself detected. Using advanced software to image data collected in a muon tomography scanner, the system also generates a three-dimensional image map indicating a threat object's precise location.



Building on the Laboratory's pioneering work with muon tomography, DSC and LANL have collaborated to create a unique cargo-scanning technology that will safely and accurately detect bare, shielded, and masked nuclear threat materials. The system harnesses muon tomography to provide vital security information without exposing system operators, bystanders, or the objects examined to dangerous radiation.

"This is a perfect example of the Lab's technology-transfer mission. Through the collaboration with DSC, Los Alamos has taken a compelling technology from scientific theory to practice and has found the right partner to transform this technology into a vital commercial product that is urgently needed in the marketplace," said Christopher Morris, principal inventor for muon tomography at LANL. "The Los Alamos and DSC teams have worked closely over the last two years and achieved huge technical advances in the development of the muon tomography technology. We're pleased to see this technology reach the marketplace through successful commercialization." The collaboration with DSC has been instrumental in moving the technology from the laboratory to practical application in a relatively short amount of time, according to Erica Sullivan, LANL's technology transfer liaison for this project. "The Lab's expertise in cutting-edge fundamental science combined with DSC's product-driven corporate culture has resulted in the rapid development of a complete scanner system, which DSC has dubbed "Guardian MT™", that will benefit the nation as a whole," said Sullivan.

Steven Oesterle, president and chief executive officer of DSC, said that, because Los Alamos has a rich history in technology development and is one of the premier global research institutions in the nuclear field, the company has been honored to work closely with Morris and the entire Laboratory team in the development of this critical technology.

"This license opens the door for us to pursue multiple applications of this transformational technology," added Michael Sossong, principal inventor of the technology, formerly with Los Alamos National Laboratory and currently director of nuclear research at DSC. "As the lead scientist with responsibility for the continued development of this technology leading to widespread commercialization, I feel a tremendous obligation to accelerate its deployment to increase the security worldwide."

For more information about the commercialization of muon tomography, contact Erica Sullivan at 505-667-9219, or eab@lanl.gov. Image: NASA image

Protein Analysis Technology

LOS ALAMOS, N.M., July 14, 2008 — Scientists who study how proteins assemble and fold into distinct shapes may soon see shape-shifting in the very methods they use, thanks to a partnership between Los **Alamos National Laboratory** and Theranostech Inc., an Albuquerque, NM-based biotechnology company.

This local startup company honed its skills in protein purification by developing an efficient test for Human Immunodeficiency Virus (HIV). Now, Theranostech will package the "Split GFP" reagents, part of the Green Fluorescent Protein Toolbox developed by Los Alamos biochemist Geoff Waldo. Promising improvements in flexibility, cost, and speed when compared with the existing fluorescent technology, Waldo's system uses green fluorescent protein (GFP) to measure the quantity and the solubility (a measure of activity) of important proteins.

These easy-to-use kits are aimed at scientists in academia and other areas outside the commercial arena to research, for example, the molecular conditions that cause Alzheimer's or other diseases involving proteins. Previously, Waldo distributed hundreds of these tools to researchers upon request, but he can no longer keep up with the skyrocketing demand. By way of an exclusive license signed in early June with LANL, Theranostech will make the tools available for purchase. In addition to helping Theranostech diversify its portfolio, said David Hadley of Technology Transfer at Los Alamos, the Lab sees this type of partnership with small, New Mexico-based companies as a valuable investment in the local community that in turn helps Lab scientists market their discoveries.

In the widely used technology, bits of GFP—derived from glowing jellyfish—attach to parts of the protein researchers look at, creating a "tag" that glows bright green in blue light. Investigators subsequently deduce structure and function from their samples. However, prior incarnations of GFP were expensive, labor intensive, or clunky, changing the behavior of critical proteins or disrupting their natural "folding," in which the chemical structure of the molecule contorts itself, ultimately determining the protein's role in a biological system.

These complications to this popular technique have hindered scientists' understanding of proteins, Waldo said. "Unlike DNA, where the technology is pretty well worked out, protein projects lagged behind," he added. That is, until now.

Waldo engineered Split GFP so that it doesn't require a lot of expensive equipment and doesn't alter protein behavior. He hopes researchers can go beyond the "low-hanging fruit" in proteomics research and probe more deeply into the mechanisms of protein function, Waldo said, adding, "Split GFP is the easiest to use and most stable *in-vitro* protein assay kit in the world right now."

For more information, visit the GFP Toolbox Web site at http://www.lanl.gov/projects/gfp/index.shtml.

Solid Electrolyte for Rechargeable Lithium Batteries

With sky rocketing gasoline prices and exploding laptops, there could not have been a better time for a new rechargeable battery breakthrough. Enter **Lawrence Berkeley National Laboratory's** (LBNL) nanostructured polymer electrolyte (NPE). NPE is a solid electrolyte designed for use in rechargeable lithium batteries. The unique material was developed by LBNL researchers Nitash Balsara, Hany Eitouni, Enrique Gomez, and Mohit Singh and licensed to startup company Seeo Inc. in 2007.

With solid financial backing from Khosla Ventures, located in Menlo Park, California, and an impressive scientific team recruited from LBNL, University of California, Berkeley, and the battery industry, Seeo is now developing a completely solid-state rechargeable Li battery with the potential to overcome the energy density – or energy storage capacity - limitations and improve the safety and lifetime of rechargeable batteries. These batteries could be employed in electric and hybrid vehicles, cell phones, laptops, and medical devices, among other applications.

Solid-state batteries containing Berkeley Lab's NPE would introduce a radically new architecture with the potential to enable electric battery-driven transportation technology. LBNL's NPE exhibits high ionic conductivity and can be engineered to be mechanically rigid enough to resist the growth of dendrites, which cause batteries to short and sometimes explode. NPE-based batteries are inherently safe because they lack the reactive and flammable organic liquid electrolytes of conventional lithium ion batteries. The safety of the new NPE may enable the use of a lithium metal anode in place of a traditional lithium ion anode, which would significantly enhance the energy density of the battery. Another advantage of LBNL's NPE is that it can readily be incorporated into casting and roll-to-roll processing methodologies already used in current lithium battery manufacturing.

Solid-state lithium ion batteries made possible by LBNL's NPE are expected to meet the energy density goal established by the Department of Energy for electric vehicles – the highest hurdle for battery technology. In addition, predictions based on recent tests indicate that Seeo batteries will achieve the United States Advanced Batttery Consortium (USABC) goal of 5,000 cycles.

Vehicles that can be powered from the electric grid will be a crucial component of society as we move toward providing increasing quantities of mobile energy while reducing greenhouse gas emissions. The combination of LBNL's nanostructured polymer electrolyte, and Seeo's all-star scientific, financial, and business team may be our best chance yet of overcoming the major barriers to achieving this long-elusive goal.

Berkeley Lab's NPE Team from left to right: Hany Eitouni, Mohit Singh, and Nitash Balsara.

PhyloChip Tracking of Bacterial Dangers

Researchers at **Lawrence Berkeley National Laboratory** (LBNL) are now able to accurately and quickly test for over 8,000 bacterial species with a device that fits into a person's hand. This new technology, called PhyloChip, enables scientists to study bacterial communities, their interactions, and how they change over time. This capability is important because deep, sudden changes in the structure of a bacterial community could represent dangers in the form of an airborne biological terrorist attack, an epidemic caused by contaminated water or soil, or hazardous atmospheric alterations caused by climate change.

Invented by Gary Andersen, Todd DeSantis, and colleagues at LBNL, PhyloChip is a DNA microarray unique in its ability to identify multiple bacterial species and organisms from complex microbial samples. Because PhyloChip produces results within hours, numerous samplings of a specific environment can be conducted on a daily basis, enabling scientists to track the progress of a certain microorganism over a short period of time.

PhyloChip was the environment category winner of The Wall Street Journal's 2008 Technology Innovation Awards and Affymetrix, Inc. is currently distributing the technology to 28 beta-test sites under a limited license agreement.

Recently, LBNL's PhyloChip was tested by cataloging the bacteria in air samples taken from San Antonio and Austin, Texas. Over 1,800 types of bacteria were found! Before this study, no one comprehended the diversity of airborne microbes. By identifying microbial communities typically inhaled by inhabitants of U.S. cities, PhyloChip can help monitor air quality. The bacterial census from this study will help the Department of Homeland Security differentiate between normal and suspicious fluctuations in airborne microbes.

Formerly, microbiologists have relied on bacterial cultures to identify the microbes present in an environmental or medical sample, but most organisms—up to 99% of the bacteria in a sample—don't survive in a culture. PhyloChip is a much more rapid, comprehensive, and accurate means for sample testing without culturing.

The LBNL technology has proven valuable in helping preserve a healthy environment. As published in *Applied And Environmental Microbiology* (2006) PhyloChip could prevent a less-soluble form of uranium from converting to a soluble form, thus forestalling the migration of this radioactive material and optimizing site remediation efforts. Monitoring contaminated sites where the existing bacteria were naturally immobilizing uranium, the PhyloChip was able to identify several synergistically acting microbes. By creating conditions more favorable for these bacteria it may be possible to increase the efficiency of immobilization.

The Berkeley Lab PhyloChip.
Photo credit: Lawrence Berkeley National Laboratory

Fission Meter: High-Sensitivity, Advanced Portable Neutron Source Identification System

International terrorist activity during the last several years has created worldwide demand for detectors that can identify fission material—an essential ingredient in nuclear explosives. To meet this demand, **Lawrence Livermore National Laboratory** (LLNL) developed an advanced neutron source identification system for the interdiction of fissionable material.

AMETEK's Advanced Measurement Technology ORTEC Division was granted non-exclusive rights to commercialize the Fission Meter technology in August 2005. The non-exclusive license grants the use of three patents (pending) and a copyright.

The ORTEC Fission Meter™ is the first portable neutron detector that can distinguish between a fissile and a non-fissile neutron source in real time. This detector provides "proof positive" identification of fissile neutron sources such as uranium-233, uranium-235, and plutonium-239, and is a valuable companion to the ORTEC Detective family of portable radiation identifiers, which is another radiation detection product based on LLNL's technology previously licensed to ORTEC. The advanced technology consists of a low-cost digital data acquisition unit that collects data at a high rate, and, in real time processes large volumes of data directly into information that a first responder can use to differentiate fissile from non-fissile materials.

Current neutron detector technologies cannot differentiate fissile from non-fissile neutrons, and therefore, are unable to locate shielded fissile material. The Fission Meter, however, can differentiate between dangerous and safe materials with very little margin of error. It collects large volumes of data and processes it directly into information that a first responder can use to discriminate materials. The Fission Meter's speed and accuracy reduce the need for intrusive inspections and monitors, and minimizes interference with daily commerce.

The Fission Meter is being marketed commercially for the U.S. Federal Government, first responders, state and local entities, and foreign governments. As one of the world's leaders in manufacturing radiation detectors and portal monitors, ORTEC has worked with U.S. government agencies, national laboratories, foreign government entities, and private industries, and is a current LLNL licensee for other homeland security technologies.

The Fission Meter technology received a 2008 Award for Excellence in Technology Transfer by the Federal Laboratory Consortium (FLC).

Instrument is arranged in a folding format to "wrap around" a suspect package for optimum counting geometry

SecureBox: National Security Through Secure Cargo

More than 200 million cargo containers are used every year to transport 90 percent of the world's cargo on trains, ships, and trucks. National security experts have identified these intermodal cargo containers as a means to deliver a weapon of mass destruction (WMD) to the heartland of the United States. **Lawrence Livermore National Laboratory** (LLNL) has developed a low-cost, reliable, reusable advanced cargo container security system to improve the security of cargo containers during shipping.

The technology is designed around an ultrawideband (UWB) communications system that allows for intrusion alarms to be reported even when cargo containers are buried many decks inside a ship and surrounded by other containers. The device uses cost-effective, low-power UWB sensors and incorporates the General-purpose Undetectable Autonomous Radar Detection Imaging and Notification system (GUARDIAN) for intrusion sensing that was developed at LLNL.

A team of LLNL engineers, in collaboration with Secure Box Corporation and the National Infrastructure Institute, tested the core technology in trans-Atlantic field trials, such as the run from Glasgow, Scotland to Lewiston, Maine, through Halifax, Nova Scotia in December 2005, February-March 2006, and May-June 2006. These trials were run by federal and state officials in Canada and the Northeastern United States. Different modes of transportation were tested including trucks, trains, barges, short-haul sea vessels, and trans-Atlantic cargo ships were tested. End-to-end communication was achieved with real-time data reporting and tracking to a secure web site. The trials resulted in zero false alarms and 100% probability of detection, including several unscheduled intrusions by dock personnel prior to loading cargo onto the vessel.

Secure Box Corporation executed a license and CRADA for the technology in September 2007. Release 1.0 is scheduled for commercial availability in fourth quarter of 2008. The device, now known as SecureBox, reliably detects intrusions through any of the container's six walls. If a breach occurs at any point during transit, SecureBox generates alarm reports to authorized individuals anywhere along the supply chain. SecureBox's end-to-end monitoring enables early detection of an intrusion, leading to timely interdiction of potential national security threats. The device also serves as a theft deterrent. SecureBox has a high probability of detection and a low false alarm rate and provides effective intrusion detection with minimal disruption to the flow of commerce.

In 2008, the SecureBox technology received a prestigious R&D 100 Award, and a Federal Laboratory Consortium (FLC) Far West Region Award for Outstanding Partnership.

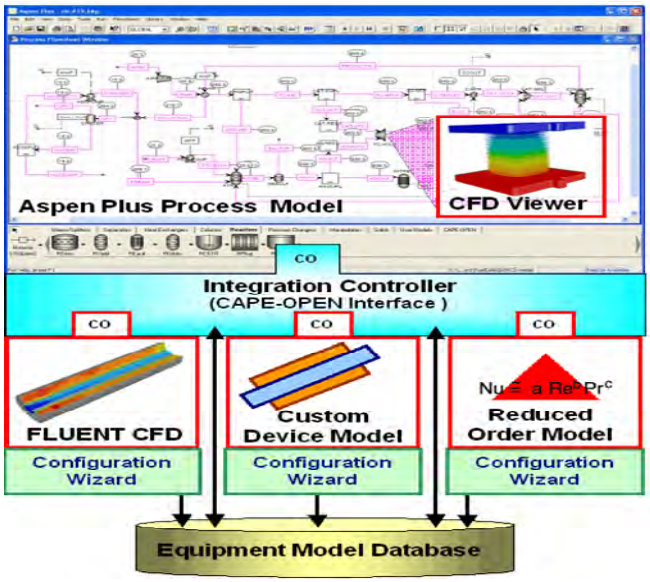
SecureBox is a wireless device that can be installed within the metal corrugation of a cargo container to detect intrusions

Advanced Process Engineering Co-Simulator (APECS)

The **National Energy Technology Laboratory's** Dr. Stephen Zitney has developed the Advanced Process Engineering Co-Simulator (APECS) software for optimizing advanced power generation systems. It incorporates ANSYS® Engineering Knowledge Manager, and provides process simulation, computational fluid dynamics (CFD), 3D plant walk-through, virtual engineering, and advanced analysis capabilities.

APECS lets engineers in the process and energy industries analyze and optimize coupled fluid flow, heat and mass transfer, and chemical reactions that drive plant performance and efficiency. Its industry-standard, multi-platform, CAPE-OPEN interfaces are designed to work with other software programs.

APECS development began in 2000 with a four-year CRADA with Fluent, AspenTech, Alstom Power, and West Virginia University. A U.S.-U.K. Memorandum of Understanding and Implementing Agreement was also initiated between NETL and the U.K.'s Virtual Plant Demonstration Model (VPDM) team.



APECS software model (Photo credit: Stephen E. Zitney)

Marketed by ANSYS Corporation, APECS licenses have been purchased by numerous users. Aspen Technology has linked APECS with Aspen Plus® modeling software and FLUENT® CFD models to optimize a solid oxide fuel cell (SOFC) auxiliary power unit. ALSTOM Power has developed APECS co-simulations of a conventional 30 MW, pulverized coal-fired, steam plant and an advanced 250 MW, natural gas-fired, combined cycle (NGCC) plant.

In 2008, R&D Magazine awarded APECS its R&D 100 Award for being one of the 100 most technologically significant products to enter the marketplace during the year.

NETL Technology Transfer Officer: R. Diane Newlon, roberta.newlon@netl.doe.gov

NREL's Optical Furnace Technology Sparks Solar Industry Interest

Applied Optical Systems, a start-up company, has recognized the great potential of the **National Renewable Energy Laboratory's** (NREL) advanced optical furnace technology for manufacturing thin-film silicon solar cells. "We'd like to develop thin-film silicon solar cells with higher efficiencies, up to 15 to 18 percent, and we believe this furnace will enable us to do so," says A. Rangappan, founder and CEO of Applied Optical Systems.

NREL Principal Engineer Bhushan Sopori has fired up an optical furnace he developed to efficiently fabricate solar cells. Credit: Ray David, NREL

Rangappan also says it will take only a few minutes for this optical furnace to process a thin-film solar cell, which reduces manufacturing costs. Overall, he estimates the company's solar cell will cost around $.80 per watt.

For manufacturing these thin-film silicon cells, Applied Optical Systems and NREL have developed a partnership through a cooperative research and development agreement to construct an optical furnace system prototype. The U.S. Department of Energy is providing $500,000 from its Technology Commercialization Fund (TCF) to develop the prototype design because of the technology's significant market potential. The TCF Program has provided NREL with a total of $4 million to expand such collaborative efforts between NREL researchers and companies.

Bhushan Sopori, a principal engineer at NREL, and his research team have advanced the technology to the point where it will benefit all solar cell manufacturers. "This advanced optical furnace is highly energy efficient, and it can be used to manufacture any type of solar cell," he says.

Each type of solar cell or manufacturing process typically requires a different furnace configuration and temperature profile. With NREL's new optical furnace system, a solar cell manufacturer can ask the computer for any temperature profile needed for processing a solar cell, and the same type of furnace is suitable for several solar cell fabrication process steps.

"In the future, solar cell manufacturers will only need this one optical furnace because it can be used for any process, including diffusion, metallization and oxidation," Sopori says. "This helps reduce manufacturing costs."

Cost-Competitive Approach for Solar Electricity

If you combine thin-film solar cells with an optical system design, you'll have a revolutionary concentrating photovoltaic (CPV) system. That is what the **National Renewable Energy Laboratory** (NREL) and Optony, Inc. are working on together. It's a brand new approach. Instead of using silicon or gallium arsenide solar cells, the system will use thin-film solar cells to be developed during the collaboration, based on technologies originally developed at NREL that hold the world efficiency record for thin-film photovoltaic solar cells.

NREL Scientists Miguel Contreras and Scott Ward will unite their expertise to develop a concentrating photovoltaic system with Optony. Credit: Ray David, NREL

CPV systems create electricity using lenses or mirrors to concentrate sunlight on high-efficiency solar cells. The energy conversion efficiency of a solar cell is the percentage of sunlight converted by the cell into electricity. Even though they're more efficient than thin-film cells, the silicon solar cells currently used for these systems are more expensive than those used for flat-plate PV systems. The multijunction gallium arsenide-based solar cells now being considered for CPV systems are the most efficient at 40%. However, they require lenses or mirrors that focus the light around 500 to 1,000 times its strength, which has some disadvantages. Because there's a lot of heat involved, you need a means to dissipate the heat away from the cell. This is difficult with silicon wafer cell technology, which is limited to the thermal properties of the cell. Thin-film cells, however, can be deposited into a variety of thermally conductive substrates. And they're cheaper to manufacture than silicon cells.

"In this respect, thin-film cells are superior in design to the silicon solar cells," says NREL Senior Scientist Miguel Contreras. "The cheaper thin-film cells and low-cost optics should lead to a less expensive product or a lower dollar per watt of electricity."

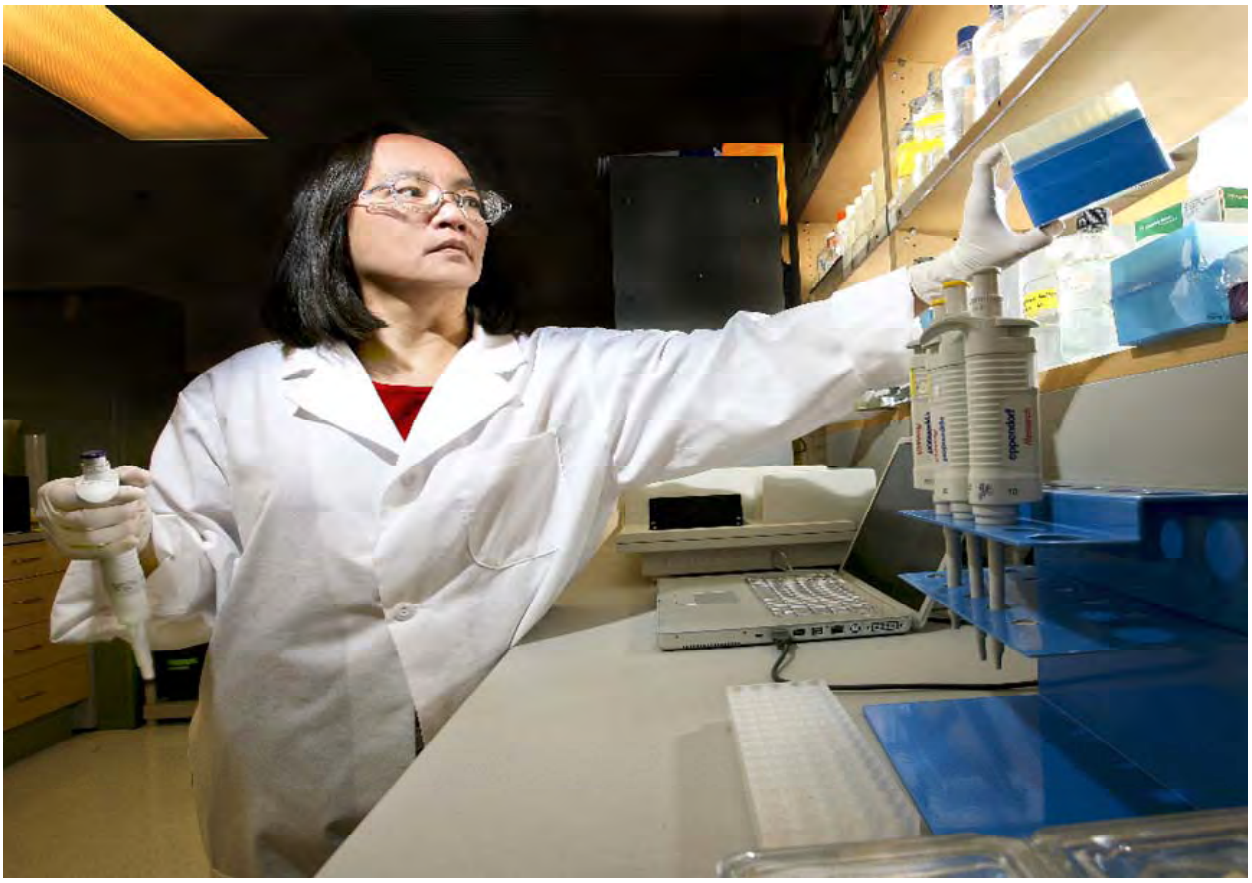
Dong Wang, the vice president of Optony, is working on-site at NREL as part of a joint team with Contreras and Scott Ward, a senior scientist at NREL specializing in concentrating solar power. "The system will not only be cheaper to manufacture, but also more reliable," Wang says. Because of this new approach's great market potential, the joint project between NREL and Optony has received $250,000 from the U.S. Department of Energy's Technology Commercialization Fund (TCF). The TCF Program has provided NREL with a total of $4 million to expand such collaborative efforts between NREL researchers and companies.

"With the additional funds provided by the TCF, we can proceed with this research in an accelerated fashion," Contreras says.

License with Bone Biologics, Inc of Los Angeles, California

The role of the Nell1 gene and its signaling pathway in the formation of bone, cartilage, skeletal muscle and cardiac muscle has been identified at **Oak Ridge National Laboratory**. This discovery is the basis for patents for applications of the Nell1 gene and protein in diagnostics and treatments for certain human diseases. UT-Battelle has patent applications that cover the Nell1 system in the three treatment areas of cartilage and vertebral disc growth, cardiac repair, and skeletal muscle regeneration. Bone Biologics, Inc., a start-up company and spinout from the University of California, Los Angeles has licensed the ORNL technology and is undertaking the development of medical products related to the diagnosis and treatment of diseases involving all forms of cartilage including growth, formation, replacement, diagnosis, remodeling, regeneration, and/or repair. The new license to ORNL's invention allows Bone Biologics to expand their Nell1 therapies from bone healing, which they are already pursuing, to the treatment of spinal disks and cartilage damage or diseases.

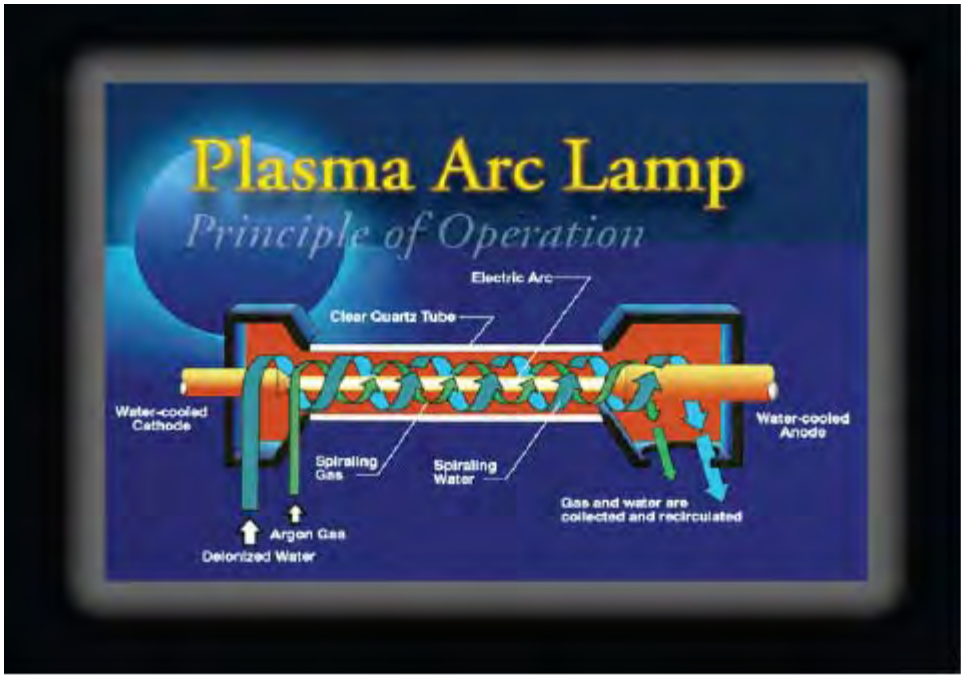
Work on the Nell1 gene and pathway required a national laboratory, specifically ORNL, because the basic science was based on studies of a special and unique mutant mouse stock generated from a large-scale mutagenesis program funded by the U.S. Department of Energy. ORNL pioneered the techniques for generating the single base mutations in the mouse genome that enabled the Nell1 research. Moreover, ORNL has comprehensive resources for conducting genetic research which include a state-of-the-art pathogen-free mouse facility, molecular biology and genomics laboratories (e.g. microarray and genotyping), and more than five decades of scientific expertise in mammalian genetics-all of which were utilized in building the Nell1-based technology.



High-intensity Arc-discharge Lamp

Oak Ridge National Laboratory researchers Craig Blue and Ron Ott have developed a technique for using a high-intensity arc-discharge lamp to nearly instantaneously heat the top layer of a material, allowing for a variety of high-throughput processes. The lamp has a capability to heat materials at a rate approaching 600,000^{o} C/s and deliver a power density up to 20 kW/cm^{2}. The lamp is capable of melting Rhenium, which has a melting point of 3180 ^{o} C. While the initial focus of development was for photovoltaic cells, the process has applicability for any thin-film deposition process that requires a material to be cured or sintered. In addition to high throughput, the advantage of this process is that it leaves the bulk material making up the substrate unchanged. This enables the use of low cost substrates that were heretofore not possible.

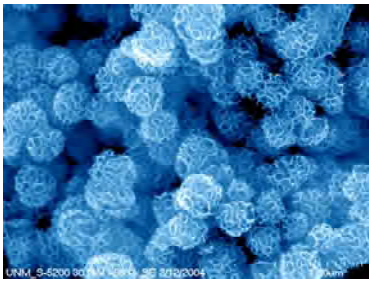
Novacentrix will be the exclusive manufacturer and distributor of the pulse thermal processing lamp systems as a part of its new license agreement. While there have been prior opportunities to partner with other companies in the recent past, Novacentrix is an optimal affiliate because its goal is to distribute the systems for as many applications as possible. This will result in the most widespread adoption of the technology possible, and will encourage the development of additional applications for the technology.



Inexpensive Fuel Cell Catalysts

Renewable energy sources are critical to the nation's future. Hydrogen-powered fuel cells offer an attractive alternative to current technologies, but more durable, efficient, and inexpensive fuel cell catalysts will be required before fuel cells are practical and cost effective. **Sandia National Laboratories** (SNL) has licensed technologies to Compass Metals, Inc., that are drawn from SNL's unique expertise in nanomaterials. These technologies may result in relatively inexpensive fuel cell catalysts with increased lifetimes.

Most fuel cells use platinum or platinum alloys as catalysts. However, the limited supply of platinum is a potential barrier to widespread fuel cell use. SNL researchers have developed innovative methods of producing platinum catalysts that offer much greater control over the shape, size, porosity, composition, stability, and other functional properties of platinum nanostructures than those achieved by existing methods. These highly efficient and durable nanostructured catalysts are expected to reduce the amount of platinum needed and thus reduce the cost of platinum catalysts for use in fuel cells, solar cells, and other applications in the renewable energy sector.



Scanning Electron Microscope Image of Platinum Foam-like Nanospheres

Sandia negotiated a license with Compass Metals for the rights to ten patents to make, use, and sell these platinum catalysts in the fuel cell area. Under a multi-year cooperative research and development agreement (CRADA), Sandia and Compass Metals are also collaborating to further improve the synthesis of platinum nanomaterials in large-scale preparations to determine the best methods for incorporating these new nanomaterials in the fabrication of fuel cell electrodes and to discover new nanomaterials.

Compass Metals is scaling up preparation of the catalysts and will work with established fuel cell manufacturers in the United States to evaluate these new catalysts and integrate them into existing fuel cell designs. Compass Metals believes that the Sandia technology transferred through license and CRADA activities is vastly superior to similar technology development efforts.

Compass Metals and Sandia decided that as the primary owner of the intellectual property, Sandia should serve as the primary contact and the ultimate licensor. Sandia, therefore, took the lead in crafting all of the required agreements with joint intellectual property owners (University of New Mexico and Toyota) to allow one unified license to be executed with Compass Metals. Separate agreements with the joint intellectual property owners made during the negotiation process will also benefit those joint owners in the sharing of license royalties.

Smart Seals

Seals have protected items of value from prehistoric times to the present, but if mechanical seals are not checked regularly, people lose confidence in them as soon as they are applied because they are not monitored directly and continuously. In nonproliferation contexts, a higher level of assurance is required. To increase confidence that seals are working as they should, **Sandia National Laboratories** (SNL) and its commercial partner, Canberra Albuquerque, are developing and commercializing smart seals that routinely "call home" to report their status and indicate when they are being tampered with.

SNL transferred to Canberra Albuquerque the technology for the T-1A optical seal, an active radio frequency-based (RF) device used to monitor high-value assets, and its technological successor, the Secure Sensor Platform (SSP). The T-1A seal makes it highly difficult to remove material or containers without breaking the seal on a fiber-optic loop. When the seal is broken, the T-1A transmits the event by RF, and an associated monitoring system collects the information for storage and review.

Sandia Optical Seal in Place on Drums of Radioactive Materials

These seals are intended for long-term use without maintenance, up to five years on one battery. The device electronics are housed in a plastic case about the size of two decks of cards and can monitor a fiber-optic loop up to 50 meters in length. The T-1A provides periodic state-of-health communications as well as immediate event notification. The device is also capable of message authentication and has active and passive tamper-indicating features.

The T-1A optical sensor extends the periods between physical taking of inventory to three years. Daily manual administrative checks are eliminated because the seals automatically "report in" several times a day. Also, the two-person rule has been eliminated for monitored material.

SNL proposed that Canberra Albuquerque commercialize the T-1A and collaborate on development of the SSP. The innovative and creative technology transfer event was combining a license agreement for the current T-1A sensor with a Cooperative Research and Development Agreement (CRADA) to jointly develop the next-generation SSP sensor. Not only was the current T-1A product brought to market successfully through the licensing of SNL intellectual property, but the CRADA will provide for a streamlined commercial launch of the SSP.

A Bigger Chill

Ultracold refrigeration helps **Thomas Jefferson National Laboratory** scientists peer into the innermost spaces of everyday objects. This knowledge of cold is also used to help astronomers gaze deep into outer space. Jefferson Lab's Cryogenics Department staff members are designing a new refrigeration plant for NASA Johnson Space Center that will be used in testing components of the next space telescope. This new, single plant will triple the capacity of the current refrigeration system. The new plant is also likely to be the first built using the award-winning, energy-saving floating pressure Ganni Cycle technology developed at Jefferson Lab.

For years, the Hubble Space Telescope has collected remarkable images of our universe, helping to answer some of astronomy's toughest questions. But the aged satellite is set to wind down in 2013, and its replacement, the James Webb Space Telescope, is currently in development.

The Systems Test Branch of the Thermal Systems Division at Johnson Space Center needs to provide a cold environment in the center's Space Simulation Chamber A for testing the new telescope. The telescope has an array of instruments that are sensitive to infrared light. Even though the craft will have a sunshield to block heat from the sun, its instruments will be exposed to heat from the spacecraft itself and from dust particles in space that reflect sunlight.

Venkatarao (Rao) Ganni, Dana Arenius, Ahmed Sidi-Yekhlef, Jonathan Creel and the rest of the cryo group, all of Jefferson Lab, are helping NASA scientists design a cryogenics plant to cool the telescope's components to temperatures its instruments will experience in space, roughly within 30 degrees Fahrenheit of absolute zero.

The new plant will extend NASA's space environment temperature capabilities in Chamber A (40 feet in diameter by 100 feet high) from about -315 degrees Fahrenheit (80-90 Kelvin) to a much lower -432 degrees Fahrenheit (15-20 Kelvin). Additionally, the Chamber A liquid nitrogen shield cooling process will be converted from the original pumped system to a thermo siphon system similar to the JLab-designed 2K cold boxes.

Dana Arenius, head of the Cryogenics Department, says his group began working with NASA in 2006. "Our role is to help them formulate their needs by developing the efficient processes and then develop the specifications, which they can use to secure the equipment they need." The procurement process has begun, with manufacturers already bidding on certain components. Interestingly, the new plant may be the first built to take full advantage of the floating pressure Ganni Cycle technology and other innovations developed by JLab staff.

The group has already helped Johnson Space Center staff upgrade the existing 15-20K cryogenics plant. The improvements have dramatically improved NASA's testing capabilities by coaxing more efficient and stable operation out of the systems. During commissioning in February 2008, NASA found that the upgrade dramatically reduced the fluctuations in refrigeration temperatures (variations were reduced from ±2.5 Kelvin to ±0.25 Kelvin). The changes also have improved system efficiency, startup reliability and simplified system monitoring, reduced liquid nitrogen requirements, and virtually eliminated two potential causes of damage to the system.

Rapid Deployment Shelter System (RDSS)

Adaptive Methods, headquartered just outside Washington, D.C., has signed a licensing agreement with the **Y-12 National Security Complex** in Oak Ridge, Tenn., to build and sell the Rapid Deployment Shelter System (RDSS), a portable disaster shelter that can be used for humanitarian assistance and disaster relief. The Enterprise Center, a nonprofit technology transfer firm in Chattanooga, assisted in identifying the RDSS technology. Y-12 also signed a Memorandum of Understanding with that firm.

“This joint venture takes advantage of the resources available in the Tennessee Valley Corridor and is a model of successful technology transfer,” said Congressman Zach Wamp. “Public-private partnerships, such as the strategic partnerships among Y-12, Adaptive Methods and The Enterprise Center, will help move technology created by the government to the marketplace while increasing our manufacturing sector in the Corridor.”

Adaptive Methods is looking at sites for its Chattanooga factory, which could cost up to $4 million to build and equip. Within four years, the company expects to employ more than 100 workers to make the high-tech shelters. "This represents a huge potential for our business, and we hope to eventually sell several hundred of these units a year," said Llew Wood, president and chief executive of Adaptive Methods. Adaptive Methods opened an office in downtown Chattanooga less than three years ago to capitalize on opportunities in the Tennessee Valley Technology Corridor and to work with the University of Tennessee at Chattanooga's SimCenter on its sonar development for the U.S. Navy. Lee Bzorgi, senior technical advisor for Y-12 who helped develop the shelter to military specifications, won an R&D 100 award for its design. “We went into this project with a great sense of urgency and commitment because we knew that our work could mean the difference in the life or death of one of our American soldiers,” Bzorgi said.

Government representatives watch as company officials from Adaptive Methods, The Enterprise Center, and B&W Y-12 sign the licensing agreement for the transfer of the Rapid Deployment Shelter System developed at the Y-12 National Security Complex.

Photo credit: Jamie Loveday, B&W Y-12

The RDSS is quickly and easily deployed using readily available power supplies and is transported by standard means. When opened, the RDSS has a floor area of about 400 square feet.

Originally designed to be a mobile surgical center by Y-12 National Security Complex Program Manager Duane Bias, applications of the RDSS are almost limitless. The shelter can serve as a command-and-control, logistics or operations center. It can be transformed into an office, classroom, laboratory, power station, storage unit and even temporary housing. The Federal Emergency Management Agency, Guard and Reserve units, homeland defense response teams, and numerous other groups could benefit from its versatility.

Appendix D: Secretarial Policy Statement on Technology Transfer at Department of Energy Facilities

Secretarial Policy Statement on Technology Transfer at Department of Energy Facilities

Introduction

This Policy Statement is designed to help guide and strengthen the Department of Energy's technology transfer efforts and to heighten awareness of the importance of technology transfer activities throughout DOE. For purposes of this document, the term "technology transfer" refers to the process by which knowledge, intellectual property or capabilities developed at the Department of Energy's National Laboratories, single-purpose research facilities, and other facilities ("Facilities") are transferred to any other entity, including private industry, academia, state and local governments, or other government entities to meet public and private needs. The Policy Statement follows upon and results from my appointment of the Under Secretary for Science as the Technology Transfer Coordinator and my creation of the Technology Transfer Policy Board (attached).

The Department of Energy's Facilities conduct technology transfer activities to ensure the fullest use of the results of the Nation's Federal investment in research and development efforts in support of DOE's mission of powering and securing America's future. The Department's technology transfer activities are to be undertaken with a special emphasis on enhancing the Nation's energy security, scientific discovery, economic competitiveness, and quality of life through innovations in science and technology. This Policy Statement builds upon the stimulus provided by the technology transfer provisions contained in the Energy Policy Act of 2005 and other recent legislative actions such as the "America COMPETES Act" that seek to improve the transfer of energy technologies from the Department's Facilities to products and applications that address public and private needs.

Guiding Principles for Technology Transfer at DOE Facilities

The conduct of the Department's technology transfer activities and the review of associated policies and procedures are to be guided by the following principles:

1. Technology transfer at DOE Facilities requires the direct involvement of the facility where the technology arose or will be further developed, and any technology transfer program plan should rely primarily on implementation by facility directors.

2. DOE Facilities must ensure fairness of opportunity, promote domestic economic interests, prevent inappropriate competition with the private sector and protect national security in partnering transactions. Globalization and U.S. competitiveness are additional factors that also must be considered.

3. It is the policy of DOE that commercialization transactions involve partners with substantial business plans to further develop and deploy the technology as expeditiously as possible.

4. In partnering transactions, DOE programs should seek opportunities to leverage DOE resources. Partnering transactions should complement DOE mission goals and objectives, including those of the National Nuclear Security Administration.

5. Royalties and equity interests received as a result of licensing transactions are not the measure of success and should not be the centerpiece for negotiation of any partnering transaction; rather, those financial returns are intended as an incentive to the scientists and facility to actively participate in technology partnering and to promote a continuing substantive business commitment by the licensee.

6. DOE Facilities should promote access by small businesses, including entrepreneurs, to accelerate commercialization of new technologies arising at the Facilities.

7. Absent overriding mission objectives, there should be consistency and streamlining in the application of policies governing technology transfer activities, and transactions should be finalized in a timely fashion to encourage universities, nonprofit institutions, and the private sector to partner with the Facilities.

8. DOE programs will work with the Facilities to establish forums to share best practices and lessons learned in furtherance of technology transfer in the Department.

Responsibilities

1. It is the responsibility of the Technology Transfer Coordinator and the Technology Transfer Policy Board to develop the Department's Technology Transfer framework, including an execution plan, performance measures, and programmatic guidance for DOE organizations.

2. The head of each DOE organizational element that funds research and development at DOE Facilities shall establish a technology transfer plan, with goals and strategies for its program and criteria to measure performance and provide accountability for technology transfer results in accordance with the DOE Technology Transfer framework.

3. The head of each DOE organizational element responsible for a DOE facility is also responsible for overseeing and evaluating technology transfer efforts at that facility. Technology transfer goals, objectives and measures shall be included as appropriate in the Facilities' performance plans.

4. Each Under Secretary shall coordinate and approve the proposed technology transfer performance plans developed by the organizations under his/her cognizance prior to submission to the Technology Transfer Coordinator.

5. All research and development programs, even those not directly targeting applied commercial applications, have a responsibility to facilitate and encourage dual use of technologies arising from their programs.

Review Requirement

The Technology Transfer Coordinator and the Technology Transfer Policy Board will immediately undertake a major review and revision as appropriate of the Department's technology transfer policies and regulations with the goal of accelerating and simplifying the process of transferring technology at DOE Facilities. The Technology Transfer Coordinator shall report to the Secretary on the results of this review and the efforts to revitalize this critical Departmental mission to meet the energy challenges of the future.

Through this Policy Statement, all DOE programs are expected to reexamine how the Department can better utilize technology transfer to power and secure America's future.

Samuel W. Bodman
Secretary of Energy

January 31, 2008
Date

The Secretary of Energy
Washington, DC 20585

June 28, 2007

MEMORANDUM FOR THE DEPUTY SECRETARY
UNDER SECRETARY
UNDER SECRETARY FOR SCIENCE
UNDER SECRETARY FOR NUCLEAR SECURITY
ASSISTANT SECRETARY FOR POLICY AND INTERNATIONAL AFFAIRS
GENERAL COUNSEL
DIRECTOR, OFFICE OF MANAGEMENT

FROM: SAMUEL W. BODMAN Sam Bodman

SUBJECT: Technology Transfer Coordinator and Technology Transfer Policy Board

Section 1001(a) of the Energy Policy Act of 2005 ("Act") requires the appointment of a Technology Transfer Coordinator who, among other duties, is to be the principal advisor to the Secretary of Energy on all matters relating to technology transfer and commercialization. In light of the significance of technology transfer activities to the Department of Energy's mission and because of the other complementary duties specified by law for the Under Secretary for Science, I hereby appoint the Under Secretary for Science as the Department of Energy's Technology Transfer Coordinator. I direct him to perform the duties of the Coordinator specified in section 1001 of the Act, and he also shall be responsible for ensuring that the other activities specified in section 1001 are carried out, including the establishment of the Technology Transfer Working Group and the preparation of a technology transfer execution plan for submission to Congress. The Under Secretary for Science shall be responsible for overseeing and for advising the Secretary on all technology transfer and commercialization activities performed by the DOE National Laboratories, single-purpose research facilities, and other DOE facilities authorized to conduct technology transfer activities.

To assist the Under Secretary for Science and to establish an enduring framework for continuity and uniformity of technology transfer activities throughout the DOE complex, the Under Secretary for Science shall chair a "Technology Transfer Policy Board" comprised of the following, all of whom shall be DOE employees: two persons designated by each of the Under Secretary for Science, the Under Secretary for Nuclear Security, and the General Counsel; one person designated by the Assistant Secretary for Policy and International Affairs; one person designated by the Director of the Office of Management; and four people

designated by the Under Secretary. In addition, the Under Secretary for Science may invite other Principal Secretarial Officers to designate representatives to serve on the Board. Because continuity and extensive knowledge of technology transfer activities within the DOE complex will be critical to the Board's effective functioning, I encourage the designation of career DOE employees for membership on the Board, rather than non-career employees.

The Board will meet periodically with appropriate Departmental officials to discuss key issues related to technology transfer activities conducted at laboratories and facilities under their cognizance. The Board will develop policy recommendations for the Technology Transfer Coordinator and monitor the overall technology transfer activities of the DOE National Laboratories, single-purpose research facilities and other DOE facilities authorized to conduct technology transfer activities. The activities of the Coordinator and the Board must comply with applicable provisions of the National Nuclear Security Administration Act.

Among other activities to be performed as requested by the Technology Transfer Coordinator, the Board shall:

- Consider the development of a Secretarial policy statement concerning the purpose and goals of the Department's technology transfer mission;
- Develop the technology transfer execution plan and annual update required by the Section 1001(g) of the Energy Policy Act of 2005;
- Oversee the activities of the Technology Transfer Working Group authorized by the Energy Policy Act of 2005, which shall consist of representatives from the National Laboratories, single-purpose research facilities and other DOE facilities authorized to conduct technology transfer activities, and from field elements responsible for overseeing the technology transfer activities conducted in the National Laboratories and DOE facilities;
- Oversee and develop proposed policies governing the use of overhead funds used to conduct technology transfer activities at a Laboratory or facility pursuant to the Technology Transfer Mission clause set forth in DEAR 970.5227-3;
- Conduct oversight activities of each technology transfer ombudsman appointed pursuant to the Technology Transfer Mission clause of DEAR 970.5227-3(p);
- Oversee and encourage efforts to engage private sector entities, including venture capital companies;
- Develop the Technology Transfer Annual report required by 35 U.S.C. 3710(f);
- Provide recommendations to the Coordinator regarding the appointment of a DOE representative to the Federal Laboratory Consortium (established by 35 U.S.C. 3710) and the Interagency Technology Transfer Working Group;

- Be responsible for oversight of, and for proposing any appropriate change to, DOE Order 482.1 DOE Facilities Partnering Programs, DOE Order 483.1 DOE Cooperative Research and Development Agreements, DOE Manual 483.1-1 DOE Cooperative Research and Development Agreements Manual, that part of DOE Order 481.1A applicable to reimbursable work for Non-Federal Sponsors, and DOE Manual 481.1A Reimbursable Work for Non-Federal Sponsors Manual;
- Develop proposed policies intended to promote consistency and uniformity applicable to User Agreements; and
- Provide recommendations to cognizant Principal Secretarial Officers on measuring the success of technology transfer programs and advise the Technology Transfer Coordinator on the oversight of and success of the Department's technology transfer program.

Appendix E:

EPAct 2005, Title X, Section 1001

TITLE X—DEPARTMENT OF ENERGY MANAGEMENT

42 USC 16391.

SEC. 1001. IMPROVED TECHNOLOGY TRANSFER OF ENERGY TECHNOLOGIES.

Establishment.

(a) TECHNOLOGY TRANSFER COORDINATOR.—The Secretary shall appoint a Technology Transfer Coordinator to be the principal advisor to the Secretary on all matters relating to technology transfer and commercialization.

(b) QUALIFICATIONS.—The Coordinator shall be an individual who, by reason of professional background and experience, is specially qualified to advise the Secretary on matters pertaining to technology transfer at the Department.

(c) DUTIES OF THE COORDINATOR.—The Coordinator shall oversee—

(1) the activities of the Technology Transfer Working Group established under subsection (d);

(2) the expenditure of funds allocated for technology transfer within the Department;

(3) the activities of each technology partnership ombudsman appointed under section 11 of the Technology Transfer Commercialization Act of 2000 (42 U.S.C. 7261c); and

(4) efforts to engage private sector entities, including venture capital companies.

Establishment.

(d) TECHNOLOGY TRANSFER WORKING GROUP.—The Secretary shall establish a Technology Transfer Working Group, which shall consist of representatives of the National Laboratories and single-purpose research facilities, to—

(1) coordinate technology transfer activities occurring at National Laboratories and single-purpose research facilities;

(2) exchange information about technology transfer practices, including alternative approaches to resolution of disputes involving intellectual property rights and other technology transfer matters; and

(3) develop and disseminate to the public and prospective technology partners information about opportunities and procedures for technology transfer with the Department, including opportunities and procedures related to alternative approaches to resolution of disputes involving intellectual property rights and other technology transfer matters.

(e) TECHNOLOGY COMMERCIALIZATION FUND.—The Secretary shall establish an Energy Technology Commercialization Fund, using 0.9 percent of the amount made available to the Department for applied energy research, development, demonstration, and commercial application for each fiscal year, to be used to provide matching funds with private partners to promote promising energy technologies for commercial purposes.

(f) TECHNOLOGY TRANSFER RESPONSIBILITY.—Nothing in this section affects the technology transfer responsibilities of Federal employees under the Stevenson-Wydler Technology Innovation Act of 1980 (15 U.S.C. 3701 et seq.).

(g) PLANNING AND REPORTING.—

(1) IN GENERAL.—Not later than 180 days after the date of enactment of this Act, the Secretary shall submit to Congress a technology transfer execution plan.

(2) UPDATES.—Each year after the submission of the plan under paragraph (1), the Secretary shall submit to Congress an updated execution plan and reports that describe progress toward meeting goals set forth in the execution plan and the funds expended under subsection (e).